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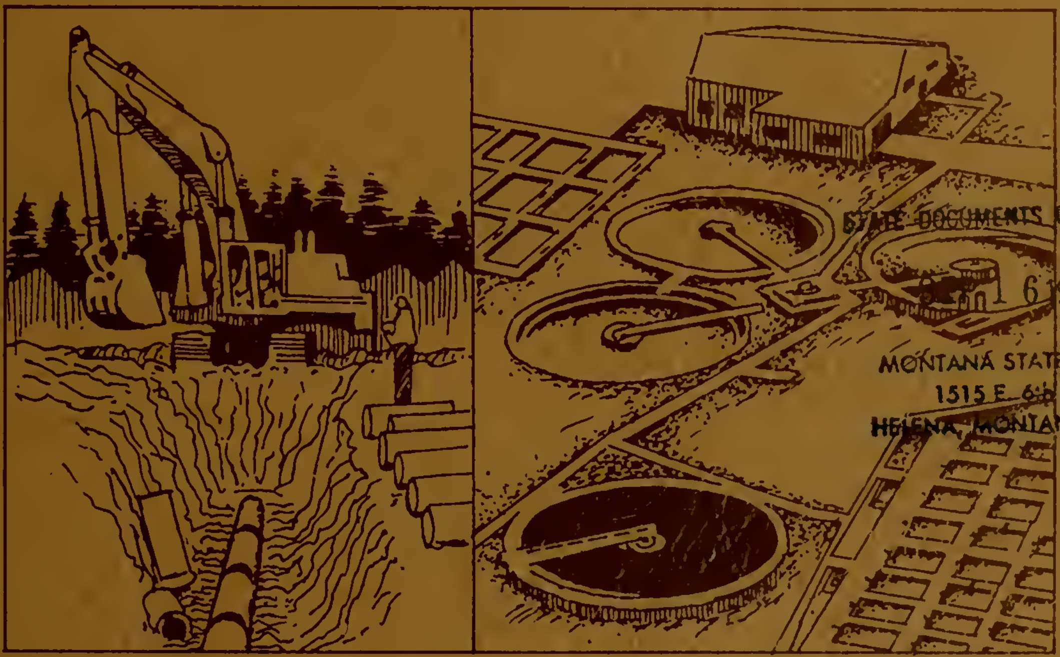
PLANNING AND DEVELOPING COMMUNITY WATER AND SEWER SYSTEMS



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PLANNING AND DEVELOPING WATER AND SEWER SYSTEMS IN MONTANA

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Part I: Introduction

A. Introduction

This text is intended to provide local communities, in particular the smaller communities in the state, with information and guidance on how to plan and develop an improvements program for their water and sewer systems. With this in mind the subject matter has been kept fairly general; however, specific approaches have been suggested. These approaches reflect the attitudes and experience of the individuals who have prepared this document, and not everyone involved in water and sewer system planning will agree with these approaches.

In order for this text to be useful, the authors felt it was necessary to commit to specific recommendations rather than offering a variety of options. It is our belief that if a community utilizes the approaches we suggest, it will lead them to sound and practical decisions on their water and sewer systems.

B. Water and Sewer Needs

There is no question that there is an urgent need for water and sewer improvements in Montana. For too long, communities have relied on past investments in water and sewer facilities to serve them. Maintenance in many cases has been inadequate, and replacement of worn-out facilities has been nil. The magnitude of the problem is dramatized by a recent survey conducted by the Montana League of Cities and Towns that showed in excess of $85 million dollars of needed capital improvements for water systems in Montana.

It is obvious that the magnitude of the water and sewer needs exceeds the financial capability of communities to finance them. Therefore, it is especially important that a community have the ability to understand their systems, set priorities, and establish appropriate capital improvements with a sound financial program.

C. Purpose

This report primarily gives a "how-to" approach to planning and developing a water and sewer improvements program. A companion document entitled "Financing Community Water and Sewer Systems in Montana" discusses establishing a financing program, and present information on available grants and loans as well as local financing options.

In order for a community to wisely invest limited funds, the community should be confident that the proposed improvements are the appropriate ones for the community. We cannot emphasize enough that a community should take at least the following steps before committing itself to any specific improvements:

- Identify feasible options that should be considered;
- Evaluate options and costs;
- Select a recommended program of improvements;
- Establish priorities; and
- Prepare a financial plan.

If a community follows these basic steps, it should be in a good position to intelligently implement a sound program of improvements.

D. Use of Report

This report is intended primarily for local government officials to assist them in establishing a logical process to evaluate their water and sewer systems and to embark upon an improvements program. It may also be useful to planners, water and sewer system operators, and engineers. However, the subject area is broad and therefore much detail on specific elements has been omitted so that the document would not be too technical or cumbersome. The document is not intended to serve as a basis for design or to substitute for good professional assistance, and should not be used as such.

Part II: The Planning Process

A. General

There are a number of ways in which a community becomes interested in improving a water and sewer system. Most of these involve one of the following: 1) requests to extend the system beyond its present capacity; 2) replacement of an outdated or worn-out facility; 3) a failure or the possibility of a failure in an existing system; 4) installation of a system where no system presently exists; or 5) to meet a regulatory requirement.

Probably the most common reason is to meet a regulatory requirement. The state and federal governments have adopted certain requirements to protect the health and safety of the public, and if a community does not have a system that meets these standards, then it will generally be required to upgrade its facilities. Since these standards change over time as techniques and knowledge increase, it is reasonable to expect that a community should periodically review its facilities to see if they are appropriate for the population being served.

Once a community has made the decision that improvements to the water and/or sewer system are required, there are certain courses of action, procedures, and options of which the community should be aware.

B. Professional Assistance

It is seldom that a small community has the expertise on its staff or in town to adequately address the technical questions involved in a water and sewer system, the regulations and standards that must be adhered to, and the programs that are available for funding such improvements. It is strongly recommended that a community consider professional assistance, even in the early stages of a potential project.

There are several sources of technical assistance that a community may wish to consider for specific problems. These include the Bureau of Mines and Geology in Butte, the State Water Quality Bureau, the State Department of Natural Resources and Conservation, the Rural Water Development Association, and various others. In most cases, however, a community will consider a private engineering or other consulting firm, which in turn should utilize available resources to the extent that they are available. The advantages of using a private firm are that the firm usually has practical experience and a broad view of water and sewer systems on which it can draw, has the ability to develop and explore various options, and can represent the best interests of the community.

There are a wide range of capabilities in engineering firms, and a community should be selective in hiring a firm since the partnership between the community and the firm will usually last throughout the duration of the project. The community should make a general rule never to relinquish the decision-making power over the type of improvements to the engineer. The engineer will provide the technical information necessary to make the decision, but the community must decide for itself what types of improvements it should implement and what it can or cannot afford.

Other considerations in selecting an engineer include: 1) references and past work record; 2) staff capability and experience; and 3) the ability of the engineer to work with the community.

An excellent way of obtaining ideas on a system is to invite proposals from engineering firms and hold interviews. After the selection process, it is usually evident which firm the community will prefer. This process is explained in detail later in this report.

Either with or without professional assistance, the community should follow a process such as the one described below which will assure that the proper decision on improvements has been made.

C. Recommended Planning Procedures

The planning process should involve the following steps in the sequence in which they are listed:

Step 1	Examine Community Growth, Land Use, and Sewer and Water Policies
Step 2	Inventory Existing Facilities
Step 3	Determine Existing Condition
Step 4	Identify Deficiencies
Step 5	Establish Feasible Options
Step 6	Hold Public Meeting
Step 7	Estimate Costs
Step 8	Evaluate Options
Step 9	Select Improvements
Step 10	Prepare Financial Plan
Step 11	Hold Public Meeting
Step 12	Develop Implementation Strategy

At the conclusion of these planning steps, the community should have a firm idea of its commitments, and the costs and benefits to the community of the proposed improvements. A description of what is involved in each step is given in the following section.

Step 1: Examine Community Growth, Land Use, and Sewer and Water Policies

The first step in the water and sewer planning process is to examine the growth in the community and current land use policies that might be in effect. Water and sewer are community services that are intended to serve developed areas. An effective water and sewer plan should be part of a more comprehensive community planning process, so that both present and future needs can be met. In particular, if a community has definite plans for future growth, the water and sewer systems (as well as other community facilities and services) should be planned to be consistent with these commitments.

Step 2: Inventory Existing Facilities

It would seem that it is foolish to adopt a program to improve a community's water or sewer system without knowing what the existing system is, yet that is what many communities have done. It should go without saying that a community should be aware of what it has invested in its existing systems before improvements are discussed. This inventory could consist of researching records available locally and at the state level, conducting an inventory of facilities, and interviewing people who are or have been familiar with the system. A record of the existing facilities should be made to document the existing systems for analysis purposes and future generations. The documentation should consist of maps, plans, lists of existing facilities, operating characteristics, and maintenance schedules.

Step 3: Determine Existing Conditions

An assessment of the condition of the existing facilities should be made. The existing conditions should include information on age, materials, location, physical condition, and operating condition of all elements of the facility. This step will provide information on the serviceability and life span of existing facilities, and will guide the community in determining repair, replacement, or new facility options. This step would also provide information to the community in establishing a capital improvements and replacement program.

Step 4: Identify Deficiencies

A comparison of the existing facilities with accepted standards provides the basis for identifying deficiencies in the system. It should be noted that operational characteristics (such as the quality of the water in a water supply system) can be deficient as well as physical elements of the system such as pumps. A deficiency analysis is the first step in establishing an improvements program.

Step 5: Identify Feasible Options

One of the most overlooked elements of the planning process is the identification of options available to the community. In this step a community should not be afraid to identify options that may appear impractical at the time. It sometimes happens that an idea may not seem practical initially, but the concept in combination with other improvements or in a revised form may prove to be feasible. The community should establish a list of feasible options, and can discard at a later date those options that can be demonstrated to be impractical. This is one of the most interesting and challenging steps in the planning process, and the community can let its imagination run free at this stage.

Step 6: Hold Public Meeting

The residents of a community will ultimately pay for the improvements to be implemented, and they are certainly entitled to voice their opinions. The depth of understanding and wealth of knowledge that many members of the community have is often surprising, and only comes to light at this time. This is the proper time to discuss the options being considered and to solicit ideas from the community. Any feasible options that are discovered should be added to the list of options. It is also advisable to offer residents the opportunity to contact a representative on a one-to-one basis to assure that those people who are uncomfortable in a public meeting have the opportunity to present their opinions.

The requirements for public participation in the planning process are also dependent on the scope of the project. Important issues that can be addressed in this step include:

- Recognition of the need for public participation;
- Development of a public participation program;
- Availability and provision of important documents;
- Public notification procedures;
- Public hearing and public meeting requirements;
- Summarizations of public participation at meetings or hearings; and
- Enforcement of public participation requirements.

These steps are required for any sewer improvements that are funded under the EPA Construction Grants Program, and are advisable for any public utility improvements. The primary purpose of public involvement is to enhance the living conditions within the community with a minimum of environmental, social and/or economic impacts. Public scrutiny of the project is the only means of ensuring that the present and future community needs are met, impacts are addressed, and effective implementation occurs.

Step 7: Estimate Costs

The major topic of interest to both the average citizen and the local official in the improvements program is "How much is it going to cost me?" A cost estimate of the feasible options that have been identified should be prepared. At this stage, a totally accurate cost estimate is not necessary, but the costs should be broken down in sufficient detail to make a valid cost comparison between alternatives. In addition, the costs should include both operation and maintenance costs as well as capital costs. It is generally more preferable to err on the side of estimating too high if possible, recognizing the inflation factor likely to occur in the intervening years before actual construction takes place.

Step 8: Evaluate Options and Establish Priorities

Cost may not be the only factor to consider. The effectiveness and reliability of the proposed option, quality of the product, life expectancy, and maintenance and operation considerations are all factors that should be taken into account during the evaluation of the options. A suggested approach is to identify the evaluation criteria and methods in advance of the actual evaluation so that an objective evaluation of options can be done and a priority list established.

Following is a list of items that should be considered in the development of a priority list:

- Desires of the existing residents;
- Physical, financial, or institutional capacities of community services;
- Dependency on meeting another community need;
- Extended planning, construction or public involvement lead times;
- Availability of funding, which may influence the project timing;
- Immediate action that may be required to preserve the community environment;
- Certain tax measures to ensure that those responsible for community growth will help to pay for expanded or new facilities;
- A mandate by the community for a certain project, regardless of anticipated impacts; and
- The necessary correction of a situation that is not in compliance with guidelines established by federal and state authorities.

Project priorities should change as conditions in the community change. For this reason, the community should not put itself into an inflexible position that limits community response to new growth. The assignment of priorities to projects does not necessarily commit the community to major expenditures, it is merely a planning tool. A simple approach to assigning project priorities would group project requests as follows:

Priority One Projects:	An already approved project to which the community is already committed; project funding and timing are inflexible.
Priority Two Projects:	A project that is needed by the community but for which funding sources are flexible.
Priority Three Projects:	A project that is desirable to the community and has great flexibility in funding and timing.
Priority Four Projects:	A project that may be necessary for the future but which is not justified at the present time.
Priority Five Projects:	A project that requires more planning and analysis before a local commitment can be made.

Step 9: Select Improvements

Based on the costs and other evaluation criteria, it should be possible to select a preferred option at this stage. The option selected at this point is known as the preferred option because there may be other complications such as right-of-way, water rights or additional information that comes to light in the future which may alter the option chosen. However, the evidence should be sufficient at this stage to determine the improvements that are the most appropriate and affordable for the community. The estimate of costs should also be refined during this step.

Step 10: Prepare Financial Plan

An adopted plan of improvements is of no use unless it can be funded. There are a number of alternatives for funding a water and sewer system that can be explored, including obtaining grant and loan assistance as well as local and private financing options. These programs are described in detail in the workbook entitled "Financing Community Water and Sewer Systems in Montana", and will not be repeated here. The financing plan should identify the capital and annual costs and the sources of funding in a detailed manner so that it is clear that the improvements program is financially feasible.

In order to develop an effective program for financing public improvements, local government must have an understanding of the elements that comprise financial planning and the effects that commitment to a financing program may have on the resources of the community. The following items will be addressed in this section: a) facility costs; b) funding sources; c) the financial plan; and d) impacts to community resources.

a. Facility Costs

A thorough understanding of detailed facility costs is a prerequisite to the commitment to a financial plan by local government. Local input at early stages of the planning process will ensure that project cost estimates are realistic and detailed enough to identify which portions of the project cost will be borne by local residents. The primary costs associated with the construction of new public facilities are for:

- Land, rights-of-way, and easements;
- Consulting services;
- Actual construction costs;
- Financing charges, including interim financing;
- Annual operation and maintenance costs;
- Administration costs; and
- Future planning costs.

As a general rule, only costs associated with the actual design and construction activities of a project are eligible for funding through grant programs. All other operation and maintenance and annual costs must be paid for by local residents.

b. Funding Sources

Alternative funding sources should be identified for all institutions or agencies affected by the implementation of the selected alternative. This analysis should identify the advantages and disadvantages of the major funding categories, including intergovernmental sources of capital and local sources of capital and operating income. Federal and state grant programs represent the most readily available source of capital for local governments. These funding sources are generally distributed according to legislated formulas or through categorical grants. Thorough investigation of these funds is necessary due to the frequent changes in state and federal grant programs. Current information on state and federal programs may be obtained through local government associations such as the Montana League of Cities and Towns or the Montana Association of Counties, through state agencies, or through the local offices of federal agencies. Program managers of a specific project are also good sources of information.

Local sources of capital and operating income are generally based on long-term borrowing over the life of the project or pay-as-you-go financing in which expenditures are funded through annual operating revenues. Local sources of capital and operating income include:

- General obligation bonds;
- Revenue bonds;
- Special assessment bonds;
- Industrial development bonds;
- Leasing arrangements;
- Special improvement districts;
- Tax measures; and
- User fees and service charges.

Selection of local financing measures may be determined by the legal and bonding capability of the community, existing taxpayer obligations, and the political climate of the community. In most cases, local financing will involve the use of several of these revenue sources in an attempt to develop a system flexible enough to respond to inflation and population growth and control the overall revenue structure of the community.

c. The Financial Plan

The information obtained from the analysis of system costs and financing methods is utilized to develop a detailed financial plan for the project. The financial plan should identify the participating agencies or institutions and their responsibilities, estimate the portion of the annual capital and operating costs each agency is obligated to meet, and identify the funding sources for each cost. The financial plan should be formulated to cover the expected life span of the facility, and should be flexible enough to adapt to new funding possibilities or changing conditions within the community.

The financial plan should also include an assessment of the local community's ability to pay for the proposed project. The local government's expenditures, revenue generating ability, and debt capacity must be reviewed. The type and amount of outstanding debts and the amount of annual revenues required for debt service is a primary indicator of the local community's ability to finance new programs. It is also beneficial to project the expected burden on each local citizen so that the "bottom line" cost can be presented to the public.

d. Secondary Impacts

Secondary impacts are the indirect environmental effects that result from the implementation of a program. These secondary impacts may be economic, social or environmental in nature, and result in both positive and negative effects on the community. Many secondary impacts may be identified during the planning and design phases of the project; however, some cause-and-effect relationships may not be apparent before the project is implemented. Typical secondary impacts are long term, and generally shown by changes in community land use patterns and in the economic nature of the community. For example, the extension of community water or wastewater services into a previously undeveloped area of the community may encourage growth in that area and thereby increase the demand for services, which may strain the financial resources of the local government. Mitigation of secondary impacts should be the responsibility of the participating agencies and institutions, and may require cooperative agreements between units of governments.

Step 11: Hold Public Meeting

Another public meeting should be held to inform the community of the selected program of improvements. At this meeting, the detailed recommendations and costs can be discussed, and the attitude of the community can be assessed. Any necessary adjustments can be made if the meeting turns up complications that were not previously evident. In particular, the financial impact on the residents of the community and the expected benefits can be presented.

Other means of disseminating the information to the public in addition to public meetings should also be considered. These could include such methods as direct mailings (possibly in water and sewer billings), advertisements in a local newspaper, notices in public places, and the like. This type of public information program in addition to public meetings would demonstrate a good faith effort on the part of community leaders to keep the public informed, and would be an effective public relations program.

Step 12: Develop Implementation Strategy

The final step in the planning process is to develop an implementation strategy. This strategy is simply an outline and description of how the community intends to have the improvements installed and put into operation; an "action plan", as it is sometimes called. The implementation strategy should contain all the major actions that have to be undertaken, and the time frame for these actions.

As with any planning process, the step-by-step method described needs to be flexible, and adjustments should be made as new or revised information becomes available or as conditions change. However, if a community follows the process as described, it should end up with a very practical and affordable program.

REFERENCES FOR PART II

1. Municipal Wastewater Management - Public Involvement Activities Guide, U.S. Environmental Protection Agency, Office of Water Program Operations, EPA Publication No. EPA-430/9-79-005, February, 1979.

2. Briscoe, Maphis, Murray, Lamont, Inc., Action Handbook: Managing Growth in the Small Community - Part II, Getting the Community Involved and Organized, EPA Report No. EPA-908/4-78-005b, July, 1978.

3. Briscoe, Maphis, Murray, Lamont, Inc., Action Handbook: Managing Growth in the Small Community - Part III, Community Action and Growth Management, EPA Report No. EPA-908/4-78-005c, July, 1978.

4. Small Community Wastewater Systems: Financial Guidelines for Planning and Management, Municipal Finance Officers Association, Government Finance Research Center.

5. William S. Foster, Handbook of Municipal Administration and Engineering, McGraw-Hill Co., New York, New York, 1978.

6. Judith Getzels and Charles Thurlow, Rural and Small Town Planning, Planners Press, Chicago, Illinois, 1979.

Part III: Implementation

A. Introduction

This section on implementation presupposes that a community has adopted an implementation plan. If it has not done so as of this stage of the project, it should prepare an implementation plan prior to continuing on its improvements program. The process leading to an implementation strategy is described in Part II of this report.

The final objective of all the work done to date was to identify the type of improvements that are appropriate for a community. If the proper procedures have been followed, the community should have chosen the improvements wisely and knowledgeably. It now remains to have these improvements installed and put into operation. This section describes the process that is typically used for this purpose. It is also assumed that the community has a financial plan as well as the implementation strategy.

B. Selecting an Engineer

Most projects of any complexity require the involvement of an engineer. The engineer's function is to prepare designs that meet with local, state and federal requirements, and to assist in quality control during construction. In many cases a community will also utilize an engineer to determine which improvements are appropriate, estimate costs, administer the project, and otherwise act as the community's representative.

In order to practice engineering in Montana (as well as other states) it is required by state law that a person must be duly registered as a Professional Engineer in Montana. An individual becomes a registered engineer by a combination of education, experience, and passing an examination intended to test knowledge of engineering principles. The intent of the engineering registration law is to protect the public by allowing only engineers of demonstrated competence to practice engineering. A list of registered engineers is available from the Montana Professional and Occupational Licensing Bureau, Montana Department of Commerce.

The typical process for selecting an engineer is as follows:

- Establish a list of qualified engineers. This can be done by calling state agencies that are familiar with engineering firms, selecting firms from the yellow pages of the telephone book, or checking with engineering societies.
- Invite letters of interest and lists of references from the engineers so selected.
- Narrow the list to three to five qualified firms and request written proposals from these firms.
- Hold interviews during which the engineers will present their qualifications so that the community can ask questions about their capabilities.
- Select an engineer from those interviewed. Notify all engineers interviewed of the selection.

This list is intended to be a generalized procedure, since some state and federal agencies or a particular financial program may have their own requirements on selecting an engineer. If a community is working with such an agency, it would be advisable to check with the agency on any specific requirements it may have in selecting an engineer.

The community may either request a proposal containing only qualifications and negotiate a fee after selecting an engineer, or it may request proposals containing fee estimates so that cost may be considered in the selection. If a community requests cost proposals, it should be very careful in comparing the kind and quality of work to be done as well as just the cost. This is particularly true in most public works projects where a good engineering design will pay for itself many times over, while a poor design may cost less for engineering but the construction may cost much more.

As with any business or profession, there is a substantial difference in the quality of engineering services between firms. The best way to investigate an individual firm is to inquire about its reputation and performance on previous projects and with other clients. It is suggested that a community check a firm's references before committing to a contract.

C. Design Plans and Specifications

The engineer is responsible for designing a facility that meets the needs of the community. The community and the engineer should be aware that there are usually a number of knowledgeable people in the community who can provide information that would facilitate the design. A wise engineer will make use of this knowledge and work closely with the people of the community to prepare a good design.

Although the engineer does the design, any decisions on options or levels of service should be made by the community. The engineer's function is to provide the community with the information needed to make the decision, and to provide recommendations.

The community should be well aware of the fact that an engineer is not infallible and can make an error just like anyone else. It has been our experience that some communities have unrealistic expectations of the engineering design, and feel that the engineer should pay for any changes that are necessary during design. Most engineering fees are not structured to allow the engineer to afford this arrangement; and if the community intends to have this requirement, then it should be explicitly stated in the agreement. Otherwise the engineer will be held to the standard of performance of other engineers in the same field, and will not be required to be perfect.

At the completion of the design the engineer will prepare a set of plans, specifications, and bidding documents. These documents (usually called "contract documents") are intended to describe the work to be done on the project, establish the type and quality of construction, and allow contractors to submit competitive bids. Clear and concise documents are necessary so that contractors can submit knowledgeable bids.

D. Construction Bids

Bid advertisements are usually published in newspapers serving the community and sent directly to contractors who are qualified in the type of construction appropriate to the project or who express an interest in the project. Lists of licensed contractors can be obtained from the Associated General Contractors office in Helena. Normally, projects are advertised for three to four weeks prior to the bid opening. The engineer typically holds a pre-bid conference to explain the project to interested contractors, and is available to answer questions on the project.

At the date and time of the bid opening, the bids are publicly opened and read aloud. Procedures for opening and reading bids are also available from the Associated General Contractors office. After the bids have been read, they are usually taken under advisement so they can be checked for errors as well as to make sure they meet the necessary bid requirements. State law requires contractors to be licensed and to submit payment and performance bonds for the project. It is also advisable to require the contractor to carry adequate insurance to protect the community.

After the bids have been reviewed and checked, the contract is awarded to the lowest qualified bidder, the necessary documents are executed, and a notice to proceed is issued by the community to the contractor.

Some financial programs may have slight variations on these procedures, and it is advised that a community review the program requirements prior to advertising, receiving, and awarding construction bids.

E. Construction

The contractor is usually responsible for scheduling all of his construction activities and deciding on the construction procedures to be used. The contractor typically submits a construction schedule so the community and engineer can provide the quality control inspections, and make necessary adjustments in public services that might be interrupted during construction.

The community should require the contractor to provide payment and performance bonds, as stated previously. These bonds insure that the workers on the project will be paid and that the project will be completed, or the bonds will be forfeited to the community. These bonds protect the community from liens, and insure that the project will be completed.

During construction the engineer either provides full-time quality control inspection or makes periodic site visits to interpret contract documents for the contractor and to assure that the quality of construction is in accordance with the contract documents. The engineer also acts as the community's representative in dealing with the contractor.

F. Start-up and Final Inspection

At the conclusion of construction the facility is tested and put into operation; this step is known as the "start-up". During start-up, the community, engineer and contractor inspect all of the facilities and determine if the work is satisfactory. Any corrections or adjustments are noted and are done by the contractor at this time.

At the completion of the final inspection and corrections, the community notifies the contractor that it has accepted the project. This relieves the contractor of the responsibility for the project, which then becomes the responsibility of the community. However, most contracts require a one-year guarantee period during which the contractor must repair any defective material or construction. The contractor's performance bond should be required to cover this one-year period.

G. Summary of Implementation

The following list summarizes in order the steps that a community typically goes through to implement a project once an improvement program, financing plan, and implementation strategy have been adopted:

1. Engineer Selection
2. Negotiation of Engineering Agreement
3. Preparation of Plans and Specifications
4. Advertisement for Construction Bids
5. Pre-Bid Conference
6. Bid Opening
7. Construction Contract Award
8. Notice to Proceed Issuance
9. Project Construction
10. Project Start-up
11. Final Inspection and Acceptance

Part IV: Water Systems

A. Introduction

In order for a community to make wise choices about its water system, the governing body must have accurate and adequate information. The information must also be presented in a readily understood manner. The content of this section on water systems is written so that it can be used as a primer in water supply and treatment to assist communities in understanding their systems. It should also prove useful in aiding communities in establishing a plan for their water system improvements.

A community water system consists of: 1) a water supply source; 2) water treatment; 3) a distribution system; and 4) storage. The purposes of the system are to provide water of adequate quantity and appropriate quality for domestic and commercial use, and for fire protection.

B. Water Supply

1. GROUNDWATER

a. Groundwater as a Resource

Groundwater is one of our most widely distributed and most important resources. It exists wherever water can penetrate into the ground and where the material beneath the surface is sufficiently permeable to transmit the water, and where the rate of infiltration is such that permeable material is saturated to an appreciable thickness. Groundwater becomes usable when the saturated zone has a large enough storage area and is permeable enough to yield a useful supply of water through wells, and when the mineral concentration that is accumulated as the water percolates through the soil does not reach such high ranges that it makes the water unfit for the desired use.

It is interesting to note that over 95 percent of the fresh water available in the United States is groundwater, and that 80 percent of all U.S. public water supply systems utilize groundwater as a source. (However, surface water is used extensively for larger areas, and more people are served by municipal supplies using surface water as a source.)

Groundwater can be considered a renewable resource. The process by which groundwater is replenished is called the hydrologic cycle. In the hydrologic cycle, water is evaporated from the oceans and land areas and becomes part of the atmosphere. The evaporated moisture is carried until it precipitates out as rain or snow. A portion of the precipitated water that falls on land infiltrates into the ground and replenishes the groundwater.

Interruptions of this cycle do occur, and can have a significant impact on groundwater resources. In some areas, groundwater is being withdrawn at a faster rate than it can be replenished, and the groundwater level is dropping. Development or other changes at the ground surface can also affect the rate at which water enters the ground, which in turn can affect the quality or quantity of groundwater. For instance, in Montana surface plowing increases the absorption of the soil and more water percolates into the ground. This water picks up minerals as it moves through the soil; when the water surfaces and evaporates it leaves a mineral residue that may not be conducive to plant growth. This process, known as saline seep, has affected a large portion of Montana's cropland.

b. Groundwater for Water Supply

If a suitable groundwater source can be found, it is an attractive method of obtaining water. Groundwater is filtered naturally, which removes sediment and organisms. The temperature and chemical quality of groundwater are generally stable over long periods of time. However, the most attractive feature of groundwater use is the cost. As opposed to surface water sources, a good groundwater source does not typically require the investment or operating costs of a water treatment plant. If a groundwater source is practical for a community, it is often the most desirable option.

The most significant problem with groundwater in Montana, in particular the eastern part of the state, is that the groundwater has a high mineral content that makes it undesirable for domestic use and may be harmful to people's health. However, even where the mineral quality is marginal, groundwater may be the only practical source available and a community may be forced to rely on such a source.

c. Groundwater Aquifers

The geologic formations that have sufficient water and transmissibility to yield water in usable quantities are called aquifers. Aquifers may be generally classed as water table or artesian. A water table aquifer is one in which the groundwater has a free surface open to the atmosphere. This upper surface is called the water table. An artesian aquifer is one in which the groundwater is confined by upper and lower layers of material of low permeability, and the groundwater is under pressure. In an artesian aquifer, the water will rise in a well to a level above the top of the aquifer.

The location of a potential aquifer should be done by a systematic and methodical investigation. Techniques that can be used include such geotechnical studies as seismic analysis, resistivity tests, electric logging, and similar methods. However, these techniques only provide indications of the probability of finding a suitable aquifer. The only positive way of estimating the yield of an aquifer is to conduct a pumping test. A pumping test typically consists of a well to be pumped and two or three monitoring wells to determine the drawdown in the water table.

d. Wells

A well is simply a shaft or hole sunken into the ground to obtain water from an aquifer. Wells are generally classed according to the method of construction: dug, bored, driven, or drilled (except for the radial collector well, which does not fit any of these classifications). These various types of wells have been developed to accommodate the variety of geologic and hydrogeologic conditions that are typically encountered. A brief description of these types of wells is given in the following narrative.

i) Dug Wells

A dug well is usually large in diameter when installed for municipal purposes and typically is from 20 to 40 feet deep. This type of well utilizes the water from all of the water-bearing formations that it penetrates, and is capable of producing large amounts of water from shallow sources. Because of the limited filtration provided by the shallow depth, dug wells can become contaminated if not protected, and may require additional treatment.

ii) Bored Wells

A bored well is constructed with hand or power augers where water can be obtained from unconsolidated formations at relatively shallow depths. These formations are usually glacial till and alluvial valley deposits ranging from about 25 to 60 feet in depth.

iii) Driven Wells

A driven well consists of a pointed screen called a "drive point" with lengths of pipe attached which is driven into deposits of sand or gravel that contain water. This type of well is generally practical only to depths of about 30 to 40 feet and is used where the water table is near the surface.

iv) Drilled Wells

A drilled well is installed by using a drilling rig to excavate or drill a well hole, and then forcing a casing down the hole to keep it from collapsing and caving in. When a water-bearing formation is found, a well screen is set in place to allow water to flow into the well while filtering out fine material in the water. Drilled wells are very versatile and can be used in shallow unconsolidated aquifers as well as deep wells. This is the type of well most commonly used for municipal purposes.

v) Radial Wells

A radial well consists of a central caisson that is sunk into a shallow aquifer with horizontal driven wells projecting outward from the bottom of the caisson into the aquifer. The radial driven wells collect the water from the aquifer, and the caisson stores the water. Under the proper circumstances and if correctly designed and constructed, this type of well can produce large quantities of good quality water. However, because the supply is usually from a shallow groundwater source, the water produced from a radial well may require a higher degree of treatment than water from a deep well.

e. Summary

In summary, groundwater has great potential for use as a water source for small communities in Montana, primarily because groundwater is generally cheaper to obtain and treat than surface water sources. However, many areas of the state do not have suitable groundwater due to a high mineral content. In the opinion of the authors, all potential groundwater sources should be thoroughly investigated before the community commits to a surface water alternative.

2. SURFACE WATER

Most large communities in Montana as well as in other states use surface water as their prime municipal water supply source. In fact, the largest volume of water (about 80%) for municipal use is taken from surface water sources. Surface water typically requires treatment because of presence of contaminants.

Surface water is typically collected in Montana by several different methods. These methods can consist of: 1) direct intake; 2) infiltration gallery; 3) induced infiltration wells; and 4) alluvial wells. Of these methods, direct intakes and infiltration galleries usually require full treatment in addition to disinfection. Induced infiltration wells and alluvial wells usually require only disinfection if the alluvial aquifer is sufficient to provide natural filtering to meet turbidity standards.

a. Direct Intake

Direct intake from a stream or reservoir can be done by either continuous draft or selective draft. Continuous draft intakes are those that take their water supply from a surface water source for the entire year. Continuous draft systems normally involve such facilities as an intake structure, intake conduit, and a pumphouse.

In some areas, low flows may have to be left undisturbed and only high waters can be captured and used. In this case, the excess water must be diverted and stored for use during the remainder of the year when water cannot be withdrawn. This process is known as selective draft.

Some communities have identified watershed areas in high and sparsely settled areas that are capable of producing and storing good quality water. Generally these watersheds have flows that vary throughout the year, and in order to be of use, the runoff must be stored in sufficient volume to assure an adequate supply. This storage is generally accomplished by constructing a dam and impounding a sufficient amount of the runoff to supply the community.

In Montana, most of the surface water supplies come from continuous draft intakes from rivers that flow all year. However, some communities such as White Sulphur Springs and Helena use impoundments from watersheds for a part or all of their water supply system.

In general, direct intakes are more practical for larger communities requiring a large amount of water which have the capability to finance a staff to maintain and operate a water treatment plant.

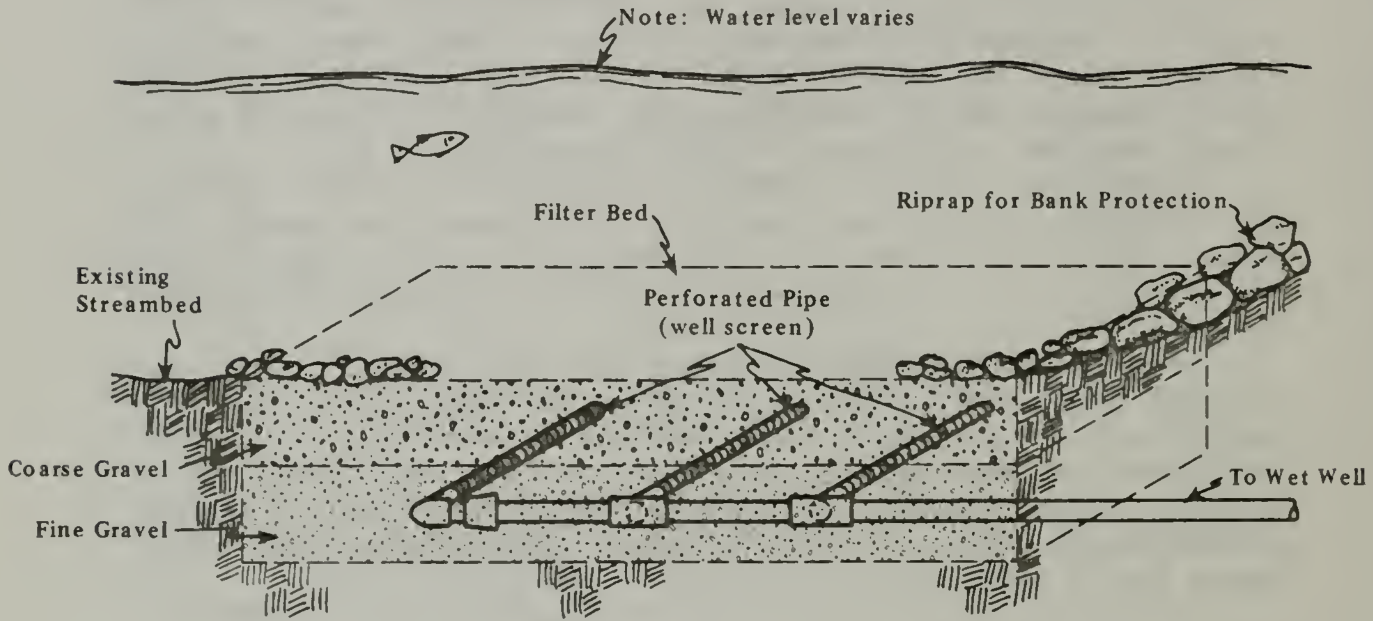
b. Infiltration Galleries

A number of communities in Montana utilize infiltration galleries adjacent to a stream to supply their water. An infiltration gallery typically consists of perforated pipe laterals which are placed either directly in the stream or immediately adjacent to the stream. The laterals are bedded in gravel of varying sizes to allow water to enter the lateral, but still offer some filtering. Infiltration galleries can work well if properly designed. However, they are prone to plugging, and provisions to periodically backwash the gallery with both air and water are suggested.

It is possible to design an infiltration gallery to provide water that could meet turbidity requirements; however, the construction would be fairly expensive and the reliability and life of the facility would be in question. In most cases an infiltration gallery is used as an intake structure with some settling and filtration, and full treatment would still be required.

A typical infiltration gallery is shown in Figure 1.

Figure 1. Typical Infiltration Gallery



c. Induced Infiltration

A concept that has not been widely practiced in Montana but is used in the Midwest and western states is a process called "induced infiltration". An induced infiltration system consists of a caisson installed adjacent to a surface water source in an alluvial aquifer. Perforated or slotted laterals are driven horizontally under the surface water source. The laterals collect water in the alluvial material under the surface water, and it flows into the caisson. As water is pumped out of the caisson, a difference in elevation in the water surface from the surface water source and the caisson induces water to infiltrate into the aquifer where it is collected by the laterals; hence the term "induced infiltration".

If the aquifer is sufficiently deep and is comprised of a suitable gradation of permeable material, the surface water is naturally filtered and the only treatment required is disinfection. Installations of this type have been in use with minimal maintenance for more than thirty years. Water quality is also very close to surface water quality.

Prior to installing such a system, an extensive hydrogeological study must be done to assure that water of adequate quantity and quality can be obtained. If an induced infiltration system is appropriate, it is usually much less expensive than a water treatment plant, and operation and maintenance costs are less.

An induced infiltration system is virtually identical to a radial well except that the laterals are directed under the surface water source, and the source of water is primarily surface water instead of groundwater.

d. Alluvial Wells

In some cases the alluvium adjacent to the stream is directly connected hydraulically to the stream and it is possible to obtain stream water that is filtered naturally by installing a bored, drilled, or dug well. Wells of this nature also rely on the induced infiltration process that was discussed in the previous section.

Alluvial wells are a relatively inexpensive source of water. However, they can become contaminated easily and may be of lesser water quality than the surface water if the groundwater in the area is highly mineralized.

3. WATER QUANTITY

One of the first elements of planning of water systems is to determine the quantity of water that the community will require. This is established both by the volume of water that will be used by the community and the rate at which the water must be delivered. Design of a water system must consider both of these factors.

The volume of water required by a community is determined primarily by the water consumed for domestic purposes and water that is unaccounted for. Unaccounted-for water is due primarily to leakage and other water losses in the water system such as tank overflows. There is some leakage in all distribution systems, and the determination of whether a leakage investigation and repairs are cost-effective is usually established by conducting a leakage study. This subject is addressed in greater depth later in this chapter.

Water use in the home typically consists of flushing toilets, taking baths, washing dishes, washing clothes, drinking, and irrigation. Water use in a community also consists of water used for commercial and industrial purposes. Most communities in the United States consume an average of about 150 gallons per capita per day (gpcd) for all uses. However, in Montana water use is considerably higher, and covers a wide range of values. The following table shows the water use in several cities and towns in Montana.

TABLE 1

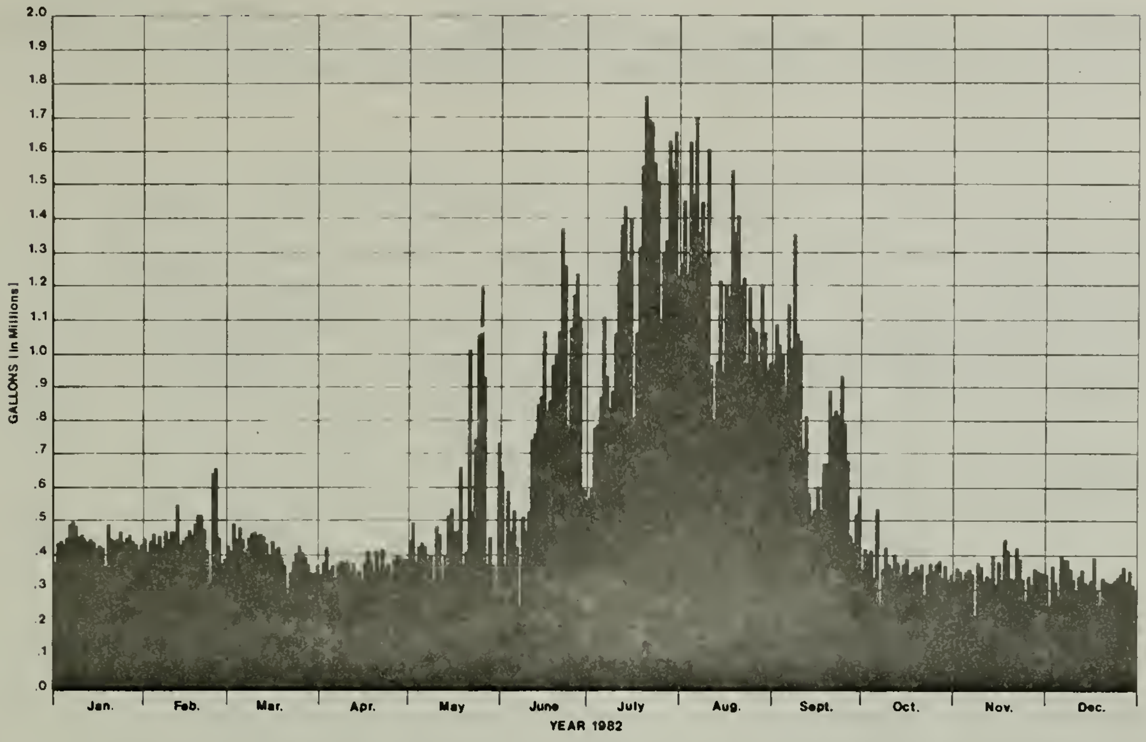
WATER USE IN SELECTED COMMUNITIES IN MONTANA

Community	Annual Water Use (gpcd)	Year Measured
Harlem	154	1979
Helena	260	1976
Shelby	190	1979
Chester	170	1980
Fort Benton	360	1982
Townsend	613	1980

Water use can vary considerably throughout the year in Montana, with the low use generally occurring in the winter months and the high use occurring in the summer when a large part of the water used is for irrigation. Some unusual water use patterns have been seen, however; for example, if a community has problems with freezing water lines, and water taps are left running continuously in the winter to prevent water services from freezing.

In designing a water system, it must be realized that each community is unique in its water use, and care must be taken to assure that the system is capable of handling both low flows and peak flows. Figure 2 shows the water used in the City of Fort Benton during the 1982 calendar year. Note that the peak use is about eight times the average use. Any water supply system must be capable of supplying the peak demand or the community will be faced with water shortages and will possibly have to restrict irrigation or ration water. Public education to encourage water conservation and/or the installation of water meters on services are means by which a community can reduce its peak and total consumption. Because of the expense of installing and reading water meters, an economic analysis comparing costs to expected savings should be conducted prior to implementing a metering program.

Figure 2. Water Use in Fort Benton, Montana



4. WATER QUALITY

Water quality is measured in terms of chemical and bacteriological quality. The generally accepted standard for the chemical composition of water to be used for domestic purposes is given in the following table. These are the published Federal Drinking Water Standards as contained in the Safe Drinking Water Act.

Bacteriological quality is concerned with waterborne organisms that cause disease. These include bacteria, protozoa, worms, viruses, and fungi. The infective disease contaminants of water are commonly classified under the heading of "bacteriological quality" because the indicators that are generally used to establish the purity of water are bacteria.

The number of pathological organisms in natural waters is small, and therefore difficult to measure. Indicator organisms that provide an indication of the presence or absence of contaminating organisms are used to measure the degree to which contamination may be present. The most common indicator is the coliform group of organisms. These organisms are used as an indicator because they may show the presence of

TABLE 2

FEDERAL DRINKING WATER STANDARDS FOR COMMUNITY WATER SYSTEMS[1]

(does not include all applicable standards)

PRIMARY DRINKING WATER STANDARDS

(For Inorganic Chemicals)

Contaminant	Maximum Level, Milligrams per Liter
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10.
Selenium	0.01
Silver	0.05
Fluoride	1.4 - 2.4[2]
Turbidity	1.0 TU[3]

SECONDARY DRINKING WATER STANDARDS[4]

Contaminant	Level
Chloride	250 mg/l
Color	15 Color Units
Copper	1 mg/l
Corrosivity	Non-corrosive
Foaming Agents	0.5 mg/l
Hydrogen Sulfide	0.05 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 Threshold Odor Number
pH	6.5 - 8.5
Sulfate	250 mg/l
TDS	500 mg/l
Zinc	5 mg/l

1. Federal Register, Vol. 40, No. 248, Wednesday, December 24, 1975
2. Level depends on annual average maximum daily air temperature
3. For monthly average. Higher turbidities may be allowed under special circumstances.
4. Federal Register, Vol. 42, No. 62, Thursday, March 31, 1977

fecal matter, and human and animal feces are the primary source of pathogenic organisms. Therefore, the presence of coliforms indicates the probable presence of such pathogens.

The standard established by the Safe Drinking Water Act is that no sample taken shall exceed one coliform organism per 100 ml of water.

C. Water Treatment

The objectives of water treatment are to provide water that is safe to drink and appealing to the consumer at a reasonable cost. Water that is safe to drink (that is free from contamination by waterborne disease) is obviously the most important consideration. Appealing water is that which is clear and colorless, pleasant to the taste, cool, non-staining, non-corrosive, and which will not form scales.

If the water source is not of a quality which meets these criteria, then it may be necessary to provide treatment of some kind before the water can be delivered to consumers.

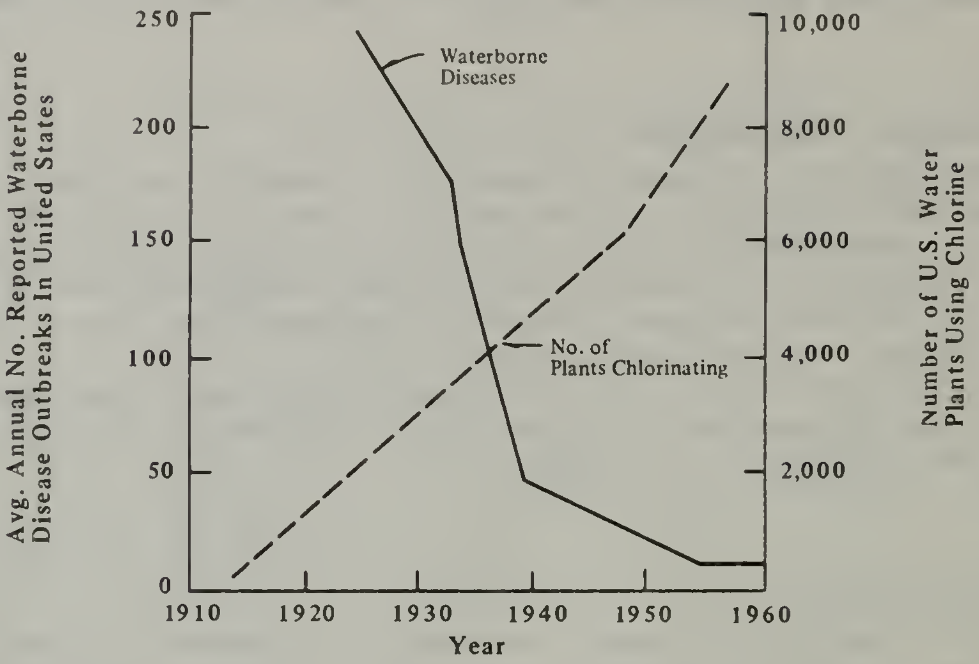
1. DISINFECTION

If a water supply system meets all of the chemical and aesthetic standards for municipal use but there is evidence of the potential for contamination by waterborne organisms, then the applicable treatment would be disinfection. Water disinfection is done to destroy or inactivate disease-producing (pathogenic) organisms.

Disinfection in community water systems is almost exclusively done by oxidizing the organic material in water through the addition of chlorine. Chlorine is a strong oxidant and a very effective germicide which has been used for disinfecting water supply systems in the United States since about 1910. The addition of chlorine to water causes a complex physiochemical reaction that is not fully understood; however, it is generally believed that the chlorine interferes with the metabolic activity of the cells, thereby causing their death.

The following figure illustrates the importance of chlorine in disinfecting water supply systems and its effectiveness in reducing waterborne diseases.

Figure 3. Effectiveness of Chlorine in Disinfecting Water Supply Systems



Average annual number of waterborne disease outbreaks, 1920 to 1960, and the number of water plants using chlorine.

Source: "New Concepts in Water Purification," Gordon L. Culp and Russell L. Culp

Other methods of disinfection include oxygenation by adding ozone, and irradiation by ultraviolet light. Both of these methods are extremely effective (generally more so than chlorine) in rapidly and thoroughly disinfecting water. However, their chief disadvantage is that they dissipate rapidly and do not provide continuous protection in the distribution system. These methods are also more energy-intensive and technically more complex than chlorination. Since the properties of ozone and ultraviolet disinfection in comparison with chlorine are in many ways complementary, it would seem that a disinfection process using both methods would provide an almost ideal form of disinfection. This is presently being done in the Netherlands at Amsterdam using a combination of ozone and chlorine. It seems logical that this combination will find increasing use in the United States as improvements in ozone and ultraviolet disinfection are made.

2. FLOCCULATION

If a treatment plant requires removal of suspended particles as well as disinfection, then a more complete process of water treatment is required. The typical water treatment process usually involves flocculation, sedimentation, and filtration.

Flocculation is the assembling of particles which have been chemically joined together into particles large and dense enough to sink to the bottom of a settling chamber. A process called coagulation, which is the driving together of colloidal particles by chemical and electrical forces, precedes flocculation.

In a treatment plant, a coagulant chemical such as aluminum sulfate (alum) and/or a flocculation aid like poly-electrolytes (polymer) are added to the raw water and vigorously mixed (rapid mixing) to diffuse the chemicals and put them into contact with the suspended particles. These small particles coalesce, increase in size, and result in a larger particle of greater density called "floc". These particles then pass into an area in the settling basins where the flow is more tranquil, velocities and disturbances are less, and the floc can settle to the bottom of the chamber.

3. SEDIMENTATION

Sedimentation is the process of settling out particles in the water by putting the water into a tranquil environment. The application of sedimentation can involve plain sedimentation or sedimentation following flocculation. Plain sedimentation is usually a pretreatment process used in waters with a heavy sediment load prior to other treatment processes. This preliminary sedimentation process is also referred to as "presedimentation".

Sedimentation following flocculation is used to remove particles that have been made more settleable by chemical treatment. Actually, flocculation and sedimentation are not totally separate processes, since some additional flocculation usually occurs in the sedimentation basin.

The effectiveness of a sedimentation basin depends on the settling characteristics of the suspended solids that are to be removed, and on the hydraulic characteristics of the settling tank. The objective of the settling tank is to reduce the velocities so that the downward settling velocity of the suspended particles exceeds the upward hydraulic velocity of the water moving through the tank, and the particles fall to the bottom of the settling tank.

After the particles have settled out, the accumulated sludge must be removed. This can be done by sloping the bottom of the settling tank to a sludge hopper, where the sludge is blown off by opening valves and flushing out the sludge. Another method is the use of a sludge scraper mechanism to move the sludge to a trough in the tank where it can be more easily removed.

4. FILTRATION

Filtration involves passing water through a porous medium such as sand for the purpose of removing suspended and colloidal material from the water. Filtration is usually thought of as a straining process; however, other physical and chemical processes are of equal or greater importance in filtering. These include adsorption, flocculation and sedimentation. Adsorption is the adhering of suspended particles to the filter grains. Flocculation and sedimentation have been explained earlier, and continue within the pore spaces of the filter. Effective filtration involves all of these processes, and if they are done correctly can result in a high quality finished water.

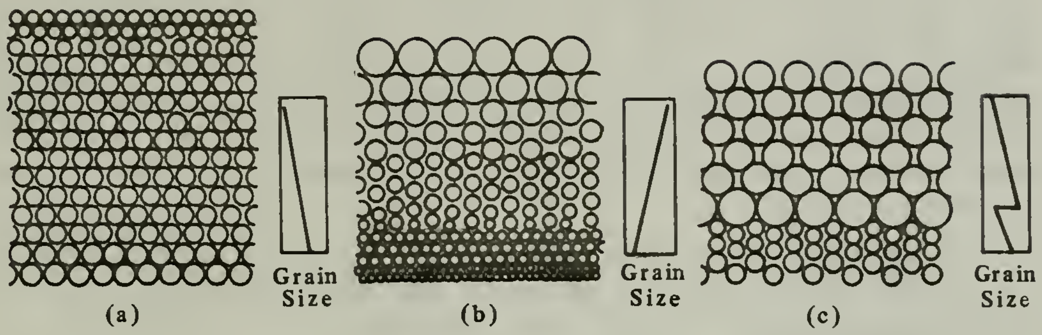
Filtration occurs naturally in groundwater aquifers which in essence filter surface water as it passes through the soil to recharge the groundwater. In some areas this groundwater recharge is artificially induced, and the natural filtering action of in-place sand and gravel is used to purify the water as it enters the groundwater regime.

In Montana as well as most other areas in the United States, the predominant method of filtering is accomplished by rapid sand filters consisting of a bed of porous sand through which water is passed to remove impurities. The rate of flow through a rapid sand filter can vary from one gpm per square foot of filter bed to as high as eight gpm. As the turbid water passes through the filter media, the impurities are deposited in the sand bed and the water is cleansed. The rapid sand filters are cleaned in place by reversing the flow through the filter (backwashing), which expands the filter media. The media is usually agitated with water and/or air to loosen the particles, and the dirty water is collected and discharged.

The primary disadvantage of a rapid sand filter is that during the backwashing period the sand is hydraulically graded and the finer material rises to the top. The influent passes through this finer material first, so the top portion of the filter bed is the only section that is used. Newer filters composed of dual media (coal and sand) or mixed media (three or more materials with varying specific gravities) are much more efficient in removing suspended particles, increasing filter runs, and reducing the amount of backwash required.

The following figure illustrates the relative effectiveness of these three types of filters.

Figure 4. Effectiveness of Filter Types



Source: "Water Treatment Plant Design," American Water Works Association, Inc.

Diagram (a) represents a single-media bed such as a rapid sand filter. The bottom half of a filter of this type does little or no work. Diagram (b) represents an ideal filter uniformly graded from coarse to fine from top to bottom. Diagram (c) represents a dual-media bed, with coarse coal above fine sand, which approaches the goal of the ideal filter.

Whenever a filter media is to be replaced or a new filter installed, the filter should be at least a dual media (coal and sand), and mixed media filters should be considered.

D. Distribution

1. DISTRIBUTION SYSTEM PIPING

The system of pipes that distributes water from the supply to the user is known as the distribution system The major components of this system are the water mains, valves, fire hydrants, and service connections. Water mains are usually laid out in a looping system so that any one location in the distribution system can be fed from two directions. This in effect doubles the amount of water that can be delivered to any one point in the distribution system. An additional advantage of a looped system is that the water cannot stand in a dead-end pipe and become stagnant. For these reasons, it is desirable and in most cases required by regulatory agencies to have looped water lines whenever practical.

a. Pressure

Pressures in the distribution system are preferred in the 50 to 80 psi range, and the distribution system should be designed to supply water at these pressures. Pressures in excess of 100 psi should be avoided, since such high pressures will increase leakage in the system and increase the chance for pipe failure as well as increasing wear and breakage problems in household fixtures. Pressure reducing valves on water mains or individual services can be used to reduce localized high pressure.

b. System Tests

The efficiency of a water distribution system can be tested by: 1) pressure surveys, which indicate the hydraulic efficiency in meeting normal flow requirements; 2) hydrant flow tests, which measure the ability of the distribution system to deliver high volumes of water; and 3) office studies of the distribution system, which typically simulate the operation of the distribution system under various conditions. A detailed study of the distribution system would likely involve a combination of all of these methods.

c. Distribution Pipes

Distribution Pipes are generally cast or ductile iron, asbestos-cement, or polyvinyl chloride. In the past, ductile iron has been predominantly used, but recently polyvinyl chloride (PVC) has been a popular choice. Each pipe material has distinct advantages and disadvantages, and the choice is usually dependent upon local conditions and performance as well as costs.

d. Valves

A distribution system should have the capability of isolating a line in the event of a leak or break. This is accomplished by installing valves at strategic locations in the system. A rule of thumb is that no more than three valves should be required to be closed to isolate a particular main. Proper valving of a distribution system assures that in the event of a localized failure, the area to which service must be disrupted to facilitate repair is kept to a minimum.

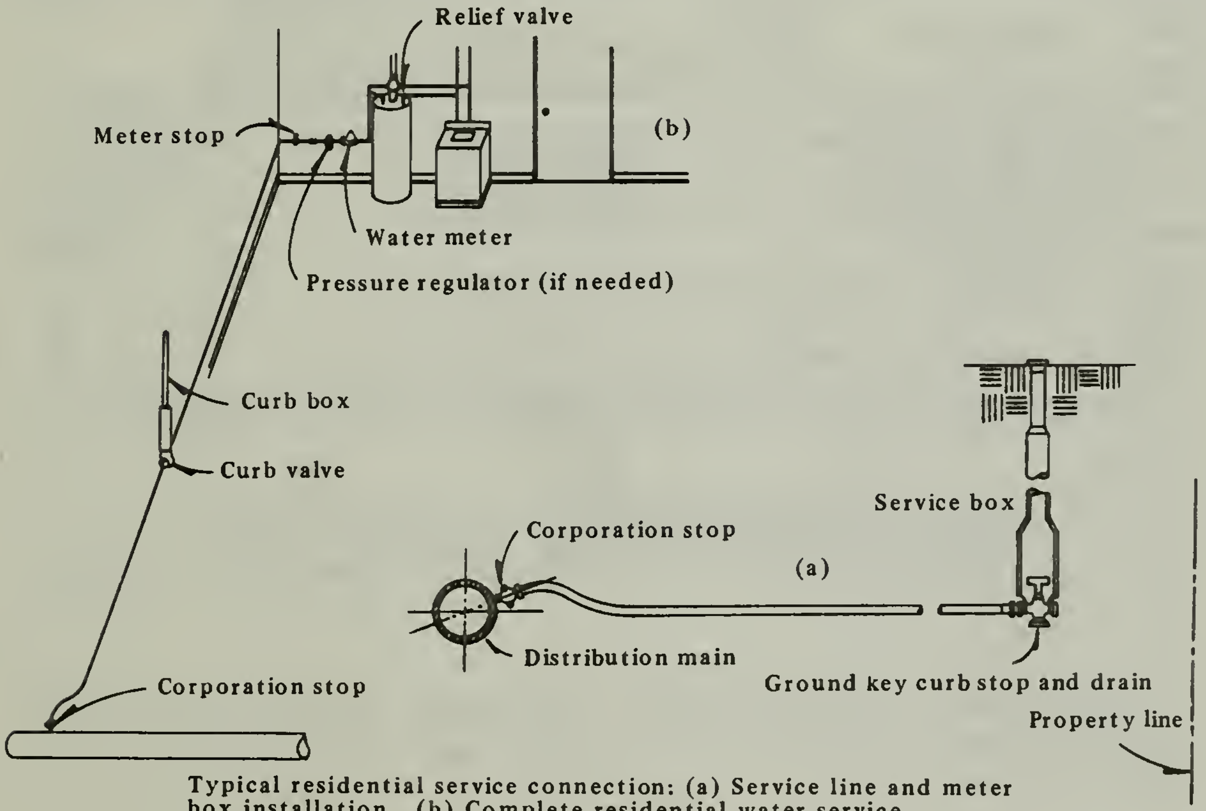
e. Fire Hydrants

Hydrants are for the purposes of providing a flow of water for firefighting, washing down streets, or flushing water mains to remove sediment. All of these purposes require high volumes of water, and fire hydrants are intended for these high flows. Water lines serving standard fire hydrants are usually at least six inches in diameter, and should be capable of supplying about 1,000 gallons per minute or more, depending on the type of land use involved.

f. Service Connections

"Service connection" is a term which describes the system by which water is delivered from the water main to the user. A service connection consists of a corporation stop (tap to the main), service line, and a curb valve and box. A typical residential service connection is shown in Figure 5.

Figure 5. Typical Residential Water Service Connection

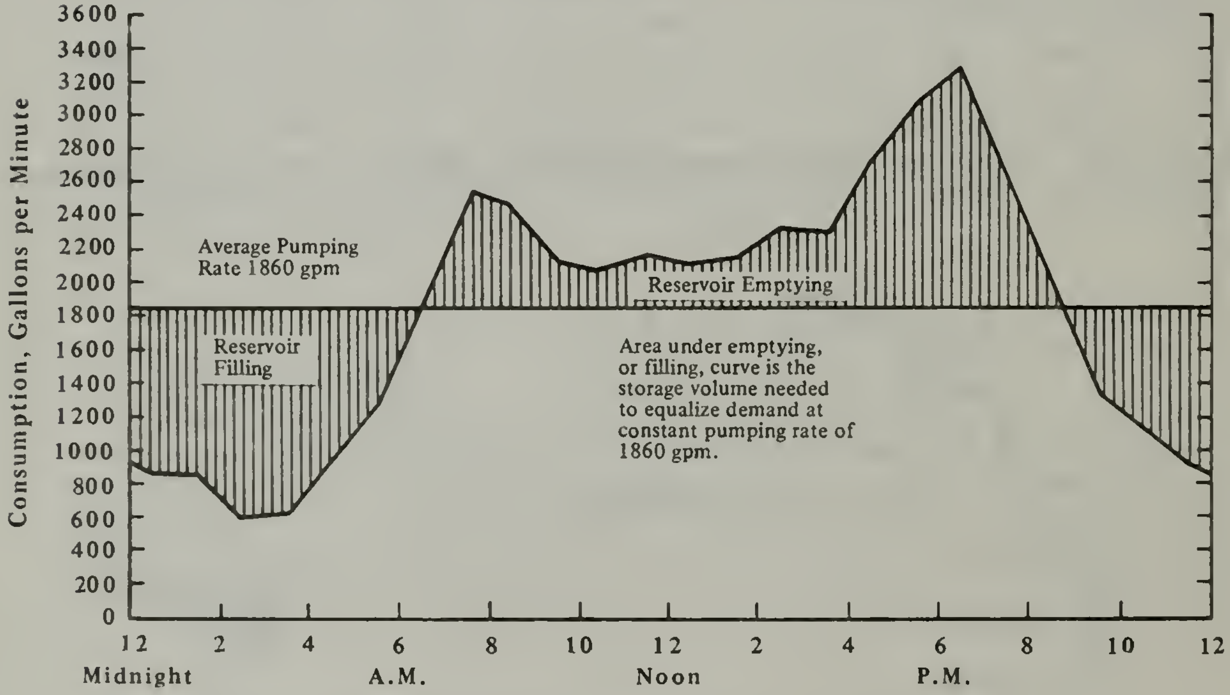


Typical residential service connection: (a) Service line and meter box installation. (b) Complete residential water service.

2. STORAGE

In most water supply systems, the water supply is not adequate to meet consumption and fire demands during peak periods. In these cases, storage will be required. The principal function of storage is to permit a continuous supply of water to be delivered into the distribution system while storing water at various locations in advance of actual need. Storage, if properly elevated, also maintains system pressure. The following figure shows the balancing of supply versus demand that is provided by a typical storage situation.

Figure 6. Water Supply Versus Demand



Plot of hourly water consumption rates to determine storage needed to equalize demand at constant pumping rate.

The amount of storage needed is the volume needed to balance demand and supply, to meet reserve requirements, and to provide adequate fire flows.

3. PUMPING

Pumps supply water from the source to the distribution system and storage. The most common pumps are vertical turbine, centrifugal, and submersible. The selection of pumps is dependent upon the reservoir or sump facilities at the source, the flow of water, the pressure, and the efficiency of the pump and motor.

In a system that maintains its pressure with storage, the pumps can be designed to supply water at a constant rate so that the pump is either on or off. In the absence of elevated storage where the system pressure is to be maintained by the pumps, a more complex pumping arrangement is required to meet the varying demands of peak and off-peak periods. If pressure is to be maintained by pumps, then a combination of high-flow pumps for fire flows and peak demand as well as low-flow pumps for off-peak demand must be installed. The recent improvements in variable-speed pumps have increased the range over which it is practical to maintain pressure with pumps; however, the efficiency of these pumps is less than that of a pump operating at a constant pressure and flow. It is usually more desirable to use elevated storage to maintain system pressure whenever practical, because it generally is more cost-effective than maintaining pressure with pumps.

4. FIRE PROTECTION

In addition to supplying water for domestic and commercial uses, a water system must be capable of supplying water for fire fighting purposes. In most cases, the size of the system is determined by the required fire flow.

Fire flows are established by the Insurance Services Office, which has its Montana office in Great Falls. This organization uses a standard for grading a municipality's ability to combat fires. The better the fire defenses of a community, the lower the fire insurance rates.

The following table shows typical fire flows required for residential units.

A municipality will have domestic and commercial water demands at the same time that a fire occurs, and an adequate water system must be capable of delivering the required fire flow and satisfying municipal consumption at the same time.

TABLE 3
REQUIRED FIRE FLOWS FOR RESIDENTIAL UNITS

Distance Between Dwelling Units (ft.)	Required Fire Flows* (gpm)
Over 100	500
31 to 100	750 to 1,000
11 to 30	1,000 to 1,500
10 or less	1,500 to 2,000
Continuous Buildings	2,500

* Where wood shingle roofs could contribute to spreading fires, add 500 gpm.

Source: "Guide for Determination of Required Fire Flow", Insurance Services Office, June, 1972.

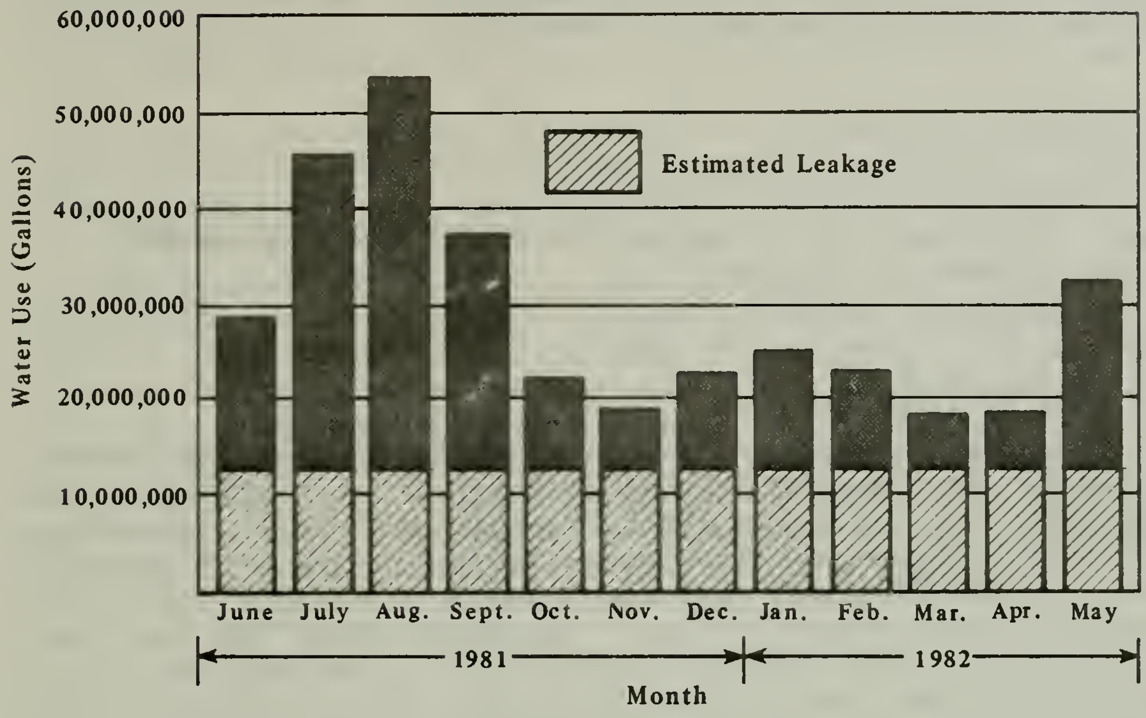
5. LEAKAGE

Every water system has a certain amount of leakage and other unaccounted-for water. However, many systems have an excessive amount of water loss, and are incurring needless expense for pumping and treating water. In some cases a community will spend a considerable amount of time and effort looking for additional sources of water, when it may be more practical and cheaper to reduce water loss in the system.

The following graph illustrates the volume of water that is potentially being lost in Townsend, Montana.

New techniques have made programs to reduce water leakage much more practical by significantly improving the ability of a community to identify locations of water losses. These techniques include specially designed electronic equipment that picks up the sound of water leaking, and flow measurements which audit the amount of water entering and leaving the system. A community should be aware of the amount of unaccounted-for water. If it is excessive, the community should consider a water audit to determine if a leakage detection and water main repair program would be cost-effective.

Figure 7. Water Use and Estimated Leakage in Townsend, Montana



E. Operation and Maintenance

Once a community has an adequate system installed, a program to keep the system in good operating condition is necessary to insure that the system is reliable. The operation and maintenance program should include a schedule of periodic inspections, replacement of worn-out or obsolete items, and properly trained personnel. Elements of a successful maintenance program include:

Adequate Staffing: The supply and treatment of domestic water is one of the most important functions of local government. If not done properly, the entire community could suffer. The process can also be quite complicated, particularly if a treatment facility is involved. Due to these factors, the personnel responsible for the water system should be adequately trained and should have sufficient time to perform their duties properly.

Preventive Maintenance: If certain elements of a water system fail, the entire water system may be shut down. The operators should be aware of the relative importance of each element of the system, and have spare parts on hand for repair or replacement or have backup systems ready. Also, a program of inspection to determine the condition of the system, and maintenance aimed at preventing failures before they occur will keep the system in good operating condition. A good maintenance schedule is a necessity if all systems are to be maintained properly.

Repair and Replacement: No mechanical equipment will last forever. Records of maintenance should be kept to alert the operators to equipment which has recurring problems. At such time that routine maintenance cannot keep the equipment in reliable operating condition, it should be repaired or replaced.

F. Water Rights

Water use in Montana is generally guided by two legal principles. First, the water user is limited to diverting only that amount he can beneficially use. The second principle is known as the "prior appropriation doctrine," that is, "first in time is first in right." A person's right to a specific quantity of water depends on when the use began. The first person to use water from a source established first right, the second person could establish a right from what was left, and so on. During a dry year, for instance, the person with the earliest date of use would have first chance at the available water to the limit of his established need. The holder of the second earliest date would have next chance, and so on.

The Montana Water Use Act of 1973 requires that any new or additional developments of surface water and groundwater made after July 1, 1973, be issued either a "Permit to Appropriate Water" or a "Certificate of Water Right." Both are granted by the Montana Department of Natural Resources and Conservation after processing.

If you are planning construction of a new or additional diversion or impoundment, a "Permit to Appropriate Water" must be applied for and received before construction begins or water is diverted.

If you plan development of a groundwater well with an anticipated use of 100 gallons per minute or more, a "Permit to Appropriate Water" must be applied for and received before development begins.

It is not necessary to apply for a "Permit to Appropriate Water" to develop wells or springs with an anticipated use of less than 100 gallons per minute. However, a well log report must be completed by the driller and sent to the Department of Natural Resources and Conservation within sixty days of drilling a well. When the well is completed, a "Notice of Completion of Groundwater Development" must be submitted to DNRC. DNRC then issues a "Certificate of Water Right" to the owner after the certificate is recorded by the local county clerk and recorder.

In an area designated as a controlled groundwater area, a permit is required in all cases to appropriate groundwater in any amount. At present, only one area in the state, containing portions of Prairie, Wibaux, and Fallon counties, has been designated a controlled groundwater area.

Further information on water rights may be obtained from the Montana Department of Natural Resources, Water Rights Division, in Helena, Montana.

G. Revenues and Expenses

The present trend in water systems is to have the system paid for and operated through user fees. The principal behind this method of financing is that the user should pay for the commodity, and should pay in proportion to the amount of water used. The water fund in a community budget should be set up as a separate account, and the revenues received from water sales and hook-up fees should pay for the operation, maintenance, and capital improvements of the system. A capital improvements reserve fund should be established to pay for the replacement of worn-out or obsolete parts of the water system.

REFERENCES FOR PART IV

1. Groundwater, American Water Works Association.

2. Fair, Geyer, and Okun, Elements of Water Supply and Wastewater Disposal, Second Edition.

3. Fair, Geyer, and Okun, Water Purification and Wastewater Treatment and Disposal, Volume 2.

4. Mark J. Hammer, Water and Wastewater Technology.

5. Recommended Standards for Water Works, 1976 Edition, Great Lakes - Upper Mississippi River Board of Sanitary Engineers.

6. Guide for Determination of Required Fire Flows, Insurance Services Office, December, 1974.

7. William S. Foster, Handbook of Municipal Administration and Engineering.

8. Water Treatment Plant Design, American Water Works Association, Inc.

9. Gordon L. Culp and Russell L. Culp, New Concepts in Water Purification.

Part V Sanitary Sewer Systems

A. Introduction

1. GENERAL

As a result of the concern for the protection of the environment and public health, coupled with the increasing population and commercial and industrial activity in the state, municipalities in Montana have constructed numerous wastewater collection and treatment systems over the past several decades. Over these years, engineers, local officials and public regulating agencies have seen wastewater management change dramatically. Individual disposal systems or basic collection systems with only primary treatment have in many cases been replaced with complex facilities involving conduits, manholes and pump stations to collect and transport wastewater, and physical, chemical and biological processes to treat wastewater.

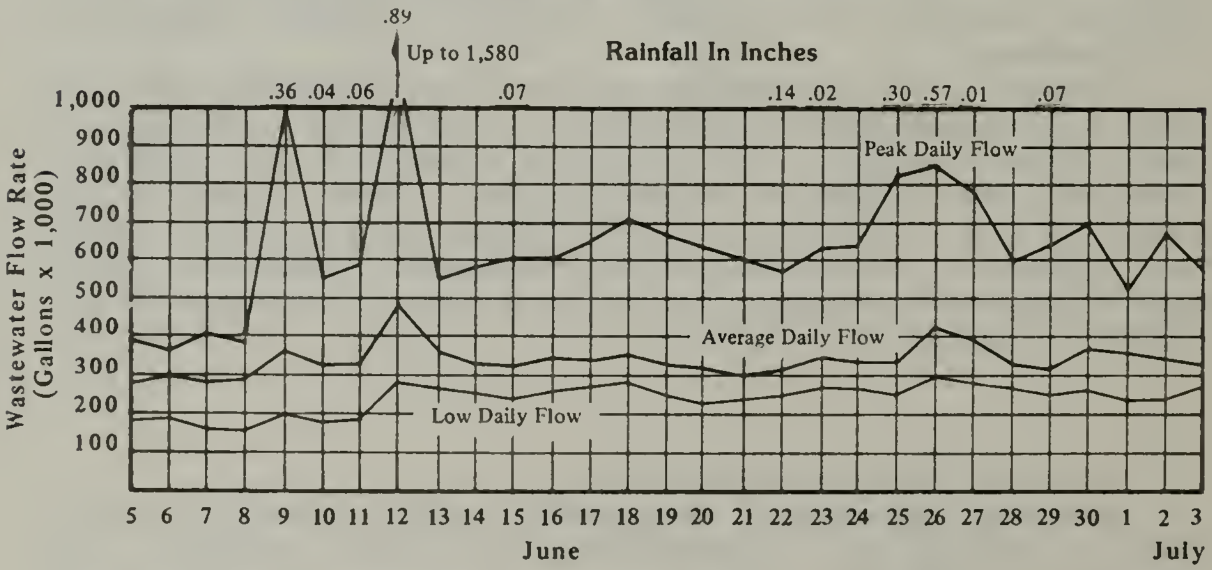
Because of the technological advances and complexities that now exist in the management of wastewater, it is impractical to discuss various wastewater systems and technologies in detail in this document. Therefore, this chapter will attempt to give a brief overview of the technology that is currently in use in Montana. Local governing bodies that anticipate a need to improve their wastewater systems can identify specific alternatives available and initiate the proper procedures to implement an improvement program.

2. WASTEWATER CHARACTERISTICS

Wastewater generated in municipalities typically consists of a composite of domestic and sometimes industrial wastes, infiltration from groundwater, inflow from surface water, and intercepted flow from combined sanitary and storm sewers. Typically, new municipal wastewater systems are based on an average daily per capita flow of 100 gallons, which includes approximately 70 gallons per capita for domestic and commercial uses and an additional 30 gallons per capita for normal infiltration and extraneous flows. In most cases, additional flows should be anticipated if industrial activity and/or high stormwater inflow are prevalent in the area. If these additional sources of flow are anticipated, a detailed monitoring program should be conducted to quantify the additional flows, since each community's situation will vary.

When designing a collection or treatment facility, care should be taken to identify the peak flows that may occur. Typically, hourly flow rates will range from a minimum of 20 percent to a maximum of 250 percent of the average daily flow for small communities, and from 50 to 200 percent for larger communities. Lowest flows usually occur during the early morning about 5:00 a.m., and peak discharges occur near midday and early evening. Peak instantaneous flows will usually occur during a major storm event when the inflow from runoff enters the wastewater collection system through manholes, combined sewers, etc. Depending on the condition of the existing collection system, the peak instantaneous flow can be significantly higher than the typical daily peak flow. In some instances, the peak instantaneous flow has been recorded at 800 percent higher than the normal flow. Figure 8 depicts the flow rate of a typical wastewater system in Montana. Note the increase in flow rates due to the precipitation in the area.

Figure 8. Wastewater Flow Rate for a Typical City in Montana



City Wastewater Flow Rate

In regard to the physical and chemical characteristics of wastewater, the most common laboratory analyses for defining municipal wastewater are Biochemical Oxygen Demand (BOD) and Solids. BOD is typically used as an indicator of the fraction of organic matter that may be degraded by microbial action in a given time period. Normally, BOD is used to measure the concentration of the waste prior to and after treatment. Five-day BODs (five-day incubation period) of municipal wastewater influent in Montana typically ranges from 100 to 300 mg/l; 20 mg/l is a recognized average. The other analytical tool for defining municipal wastewater is Solids, which are typically measured as Total Solids (TS), Total Suspended Solids (TSS), and Total Dissolved Solids (TDS). The measurement of these fractions may be used to assess wastewater strength, treatment process efficiency, and unit loadings. Total Solids of municipal wastewater influent usually varies from 350 to 1,200 mg/l, with dissolved solids comprising approximately two-thirds and the suspended solids approximately one-third of the total. An average figure for TSS is 250 mg/l.

3. EFFLUENT LIMITATIONS

The Montana Department of Health and Environmental Sciences, Water Quality Bureau administers the Montana Water Pollution Control Act and the Montana Pollutant Discharge Elimination Permit Program. Under this program, all waterways in the state are classified according to water quality standards adopted in 1973 and revised in 1980. The permit system applies to point sources of pollution discharging to surface waters. In order to obtain a Discharge Permit, a municipality must have an acceptable wastewater treatment plant which will meet the standards for the particular location and waterway to be affected. Under the permit program, each permit holder is required to periodically sample and test the effluent and report the findings to the State Water Quality Bureau. Typical information that must be submitted includes flow rate, BOD, Total Suspended Solids, fecal coliforms, and pH.

B. Collection Systems

1. GENERAL

Until about thirty years ago, only the larger communities in Montana utilized municipal collection and treatment facilities to dispose of the wastewater generated in their communities. Smaller communities and rural areas generally utilized individual treatment systems consisting of septic tanks, mound systems, evapo-transpiration systems, etc. In recent years, however, the need to install central wastewater systems in smaller communities as well as the need to expand existing collection systems in larger communities has developed. This development can be attributed to several factors: 1) the increasingly stringent regulations that have been promulgated to control the quality of wastewater effluent; 2) increasing population densities and a corresponding lack of land for individual systems; and 3) hydrogeologic conditions that in many areas are not conducive to the use of individual systems, such as high groundwater, impermeable soils, bedrock outcroppings, or a combination of all three.

Typically, a central collection system consists of service lines, laterals, interceptors, and manholes. In addition, lift stations and force mains may be required if topography does not allow the wastewater to flow by gravity from the point of generation to the treatment facility. Because of the increasing need for central community wastewater systems, the following narrative has been prepared to acquaint local officials with the various components and alternatives available for the centralized collection and treatment of wastewater.

2. ALTERNATE COLLECTION SYSTEMS

There are numerous types of wastewater collection systems that have been developed and utilized throughout the nation. Practically speaking, there are four types of systems in use in Montana. A brief description of each of these is included herein.

a. Conventional Gravity System

A conventional gravity sewage system is by far the most commonly used system in Montana. The components are presented in Figure 9. As illustrated, these components include sewer services, laterals, trunk lines, major interceptors, and manholes.

i) Sewer Mains

Normally, all sewer mains should be designed and constructed with sufficient slopes to maintain self-cleaning velocities (normally assumed to be 2.0 ft/sec when the pipe is flowing full). Where velocities are greater than 15 ft/sec, special provisions should be made to protect the pipe and manholes against displacement by erosion and hydraulic thrust. Typically, sewer services should be laid with minimum preferred grades of ¼"/ft. In most instances, it is recommended that sewer services be constructed with a minimum of four-inch diameter pipe, and laterals and trunk lines constructed with pipe not less than eight inches in diameter. All pipe should be laid with constant slopes between manholes, since pipes laid on too flat a grade or with varying slopes will require regular flushing and cleaning to remove deposited solids. Manholes should be placed at all changes in sewer grade, pipe size or alignment; at all intersections; at the end of each line; and at distances not great-

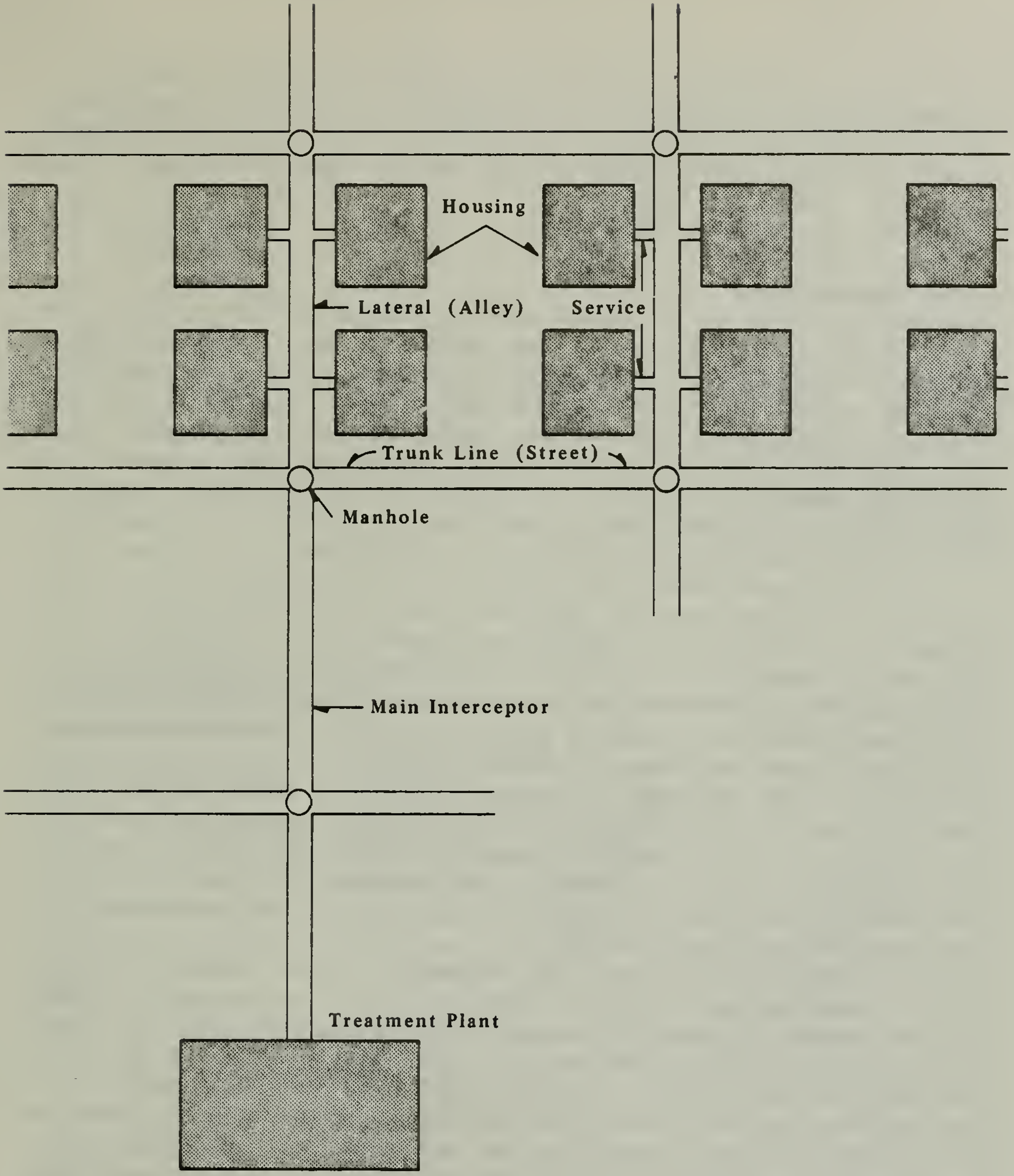


Figure 9. Conventional Gravity Sanitary Sewer System

er than 400 feet along pipe runs. A terminal cleanout may be substituted for a manhole at the end of a short lateral. Such a cleanout basically consists of an upturned pipe extending to the ground surface so that flushing equipment can be inserted. This type of cleanout should not be installed at the end of a lateral greater than 150 feet from a manhole.

ii) Pipe Materials

Vitrified clay was the most widely used material for sewer pipe until just recently. This pipe is manufactured of clay, shale, or a combination thereof. Vitrified clay pipe (VCP) is extremely resistant to corrosion by acids and alkalis, and is not subject to damage by sulfuric acid generated by hydrogen sulfide, as is the case with certain types of concrete pipe when sewers do not run completely full. Clay pipe is also highly resistant to erosion and scour. VCP is normally limited in size from 4 to 36 inches in diameter, and typically is constructed in two- to seven-foot lengths, depending on the diameter.

Within the past five to ten years, the most commonly used material for sewer mains and services has been polyvinyl chloride (PVC). The increasing use of PVC pipe is generally attributable to the light weight and ease of installation as well as its exceptional resistance to corrosion and deterioration. Standard PVC pipe comes in sizes varying from four to fifteen inches; however, PVC pipe as large as 30 inches in diameter has recently been introduced by manufacturers. Typically, such large diameter PVC pipe must be reinforced by one of a number of methods, depending on the manufacturer. During the early development of PVC sewer pipe, leaky joints were common due to the use of solvent welded joints. In recent years, however, most manufacturers have corrected this deficiency by utilizing a gasketed bell and spigot connection that has proven to be quite watertight.

In addition to clay and PVC materials, the third most commonly used material for sewer pipe is concrete. Precast concrete sewer pipe may be obtained in many sizes with several types of joints. Nonreinforced concrete pipe is available in 4- to 24-inch diameters in three- or four-foot lengths. The bell and spigot ends are normally joined by using a rubber ring gasket. Circular reinforced concrete pipe, produced in sizes ranging from 12 to 108 inches, is available in five classes based on strength. Since concrete is subject to attack by acids, it generally is not used for small-sized sanitary sewers where industrial wastes or hydrogen sulfide production is likely to cause internal corrosion. However, reinforced concrete pipe is installed for sanitary trunk sewers where the diameter exceeds the available sizes of vitrified clay or PVC pipe. Here the installation may be protected by control of acidic, high-temperature, or high-sulfate wastes by adding chemicals to control biological growth, maintaining flushing velocities and adequate ventilation, and installation of pipe lining if necessary. Epoxy or plastic lining may be cast into the concrete pipe during manufacture, or bitumastic or coal-tar epoxy may be painted on the concrete pipe surfaces after installation.

Besides these common materials, cast iron, ductile iron, and asbestos cement materials are sometimes utilized for special applications such as force mains, treatment plant piping, etc. These materials are generally, however, not used for conventional gravity sewer systems.

iii) Manholes

In regard to the construction of manholes, most are circular in shape with a typical inside diameter of four feet, which is considered sufficient to perform sewer inspection and cleaning. For most size sewers, manholes are usually constructed of pre-cast concrete and located directly over the center line of the sewer. Manhole frames and covers are usually cast iron with a minimum clear opening of 21 inches. Solid covers should be used to minimize the inflow of stormwater runoff. Wastewater flow should be conveyed through the manhole in a smooth, U-shaped channel formed in the concrete base. Where more than one sewer enters a manhole, the channels should be curved to merge the flow streams.

b. Small-Diameter Sewer Systems

Unlike conventional gravity sewer systems in which all wastewater generated enters the central wastewater collection and treatment system, a small-diameter system is based on the concept that each dwelling will utilize a septic tank to settle and partially digest solids. These solids must then be periodically pumped and transported by vehicle to a plant for treatment and disposal. The liquid portion of the wastewater from each septic tank then flows into the collection system and ultimately to a central treatment plant or land application facility. The primary advantage of this concept compared to the conventional gravity sewer system is that since solids do not enter the collection system, the central collection piping can be comprised of significantly smaller diameter pipe. The primary disadvantage of this concept is the expense involved in installing and maintaining a septic tank for each dwelling.

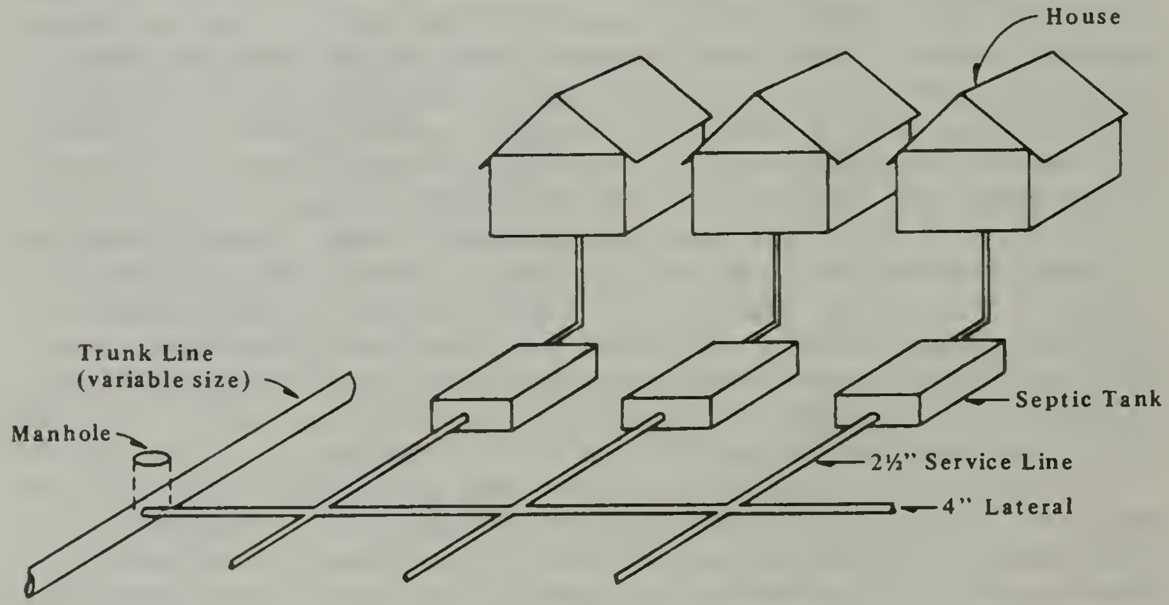
In most instances, small-diameter sewer systems are cost-effective compared to conventional gravity sewer systems when a combination of the following circumstances exist: 1) high groundwater or bedrock outcrops resulting in extremely high costs for conventional sewer main construction; 2) low population densities and unusually long distances between dwellings; and 3) terrain that precludes the use of gravity systems without numerous lift stations. Since there are fewer solids in the effluent, lines may be laid at shallower slopes. This can result in reduced excavation depths and cost savings. In addition, less expensive cleanouts may be used in lieu of conventional manholes.

Various types of small-diameter sewer systems are available. Included herein is a brief description of the three systems that are most applicable in Montana.

i) Small-Diameter Gravity Sewer

This alternative assumes that the effluent from septic tanks would be discharged into a 2½-inch PVC service line rather than the four-inch service line that would be used in a conventional gravity sewer system. This effluent would then be conveyed to a central collection system consisting of four-inch and larger gravity sewer main. (As previously noted, the minimum size for a conventional gravity system sewer main is eight inches in diameter.) The system would also include a minimal number of manholes for routine maintenance and cleaning, spaced farther apart than for a conventional system. These manholes would be supplemented with cleanouts in between. These systems are typically used when a community has septic tanks in place with failing drainfields, and the septic tank effluent can be transported to a central treatment facility by gravity. A typical small-diameter gravity sewer system is illustrated in Figure 10.

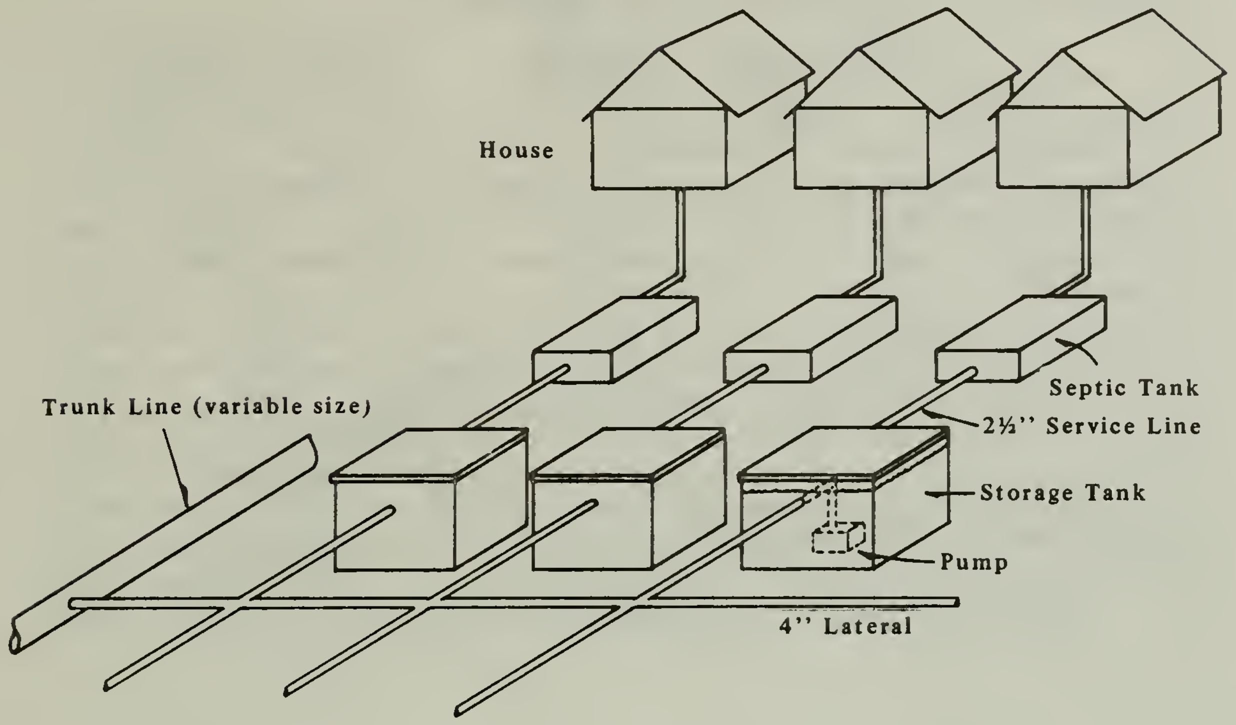
Figure 10. Small-Diameter Gravity Sewer System



ii) Small-Diameter Pressure Sewer

This system utilizes a central collection system consisting of small-diameter PVC pipe. Each dwelling utilizes a pump and an 1¼-inch service line to force sewage into and through the central collection system. This system can be quite cost-effective when topography in the area is rolling and does not permit gravity flow throughout the service area such as in a recreational subdivision. A typical pressure sewer system is illustrated in Figure 11.

Figure 11. Small-Diameter Pressure Sewer System



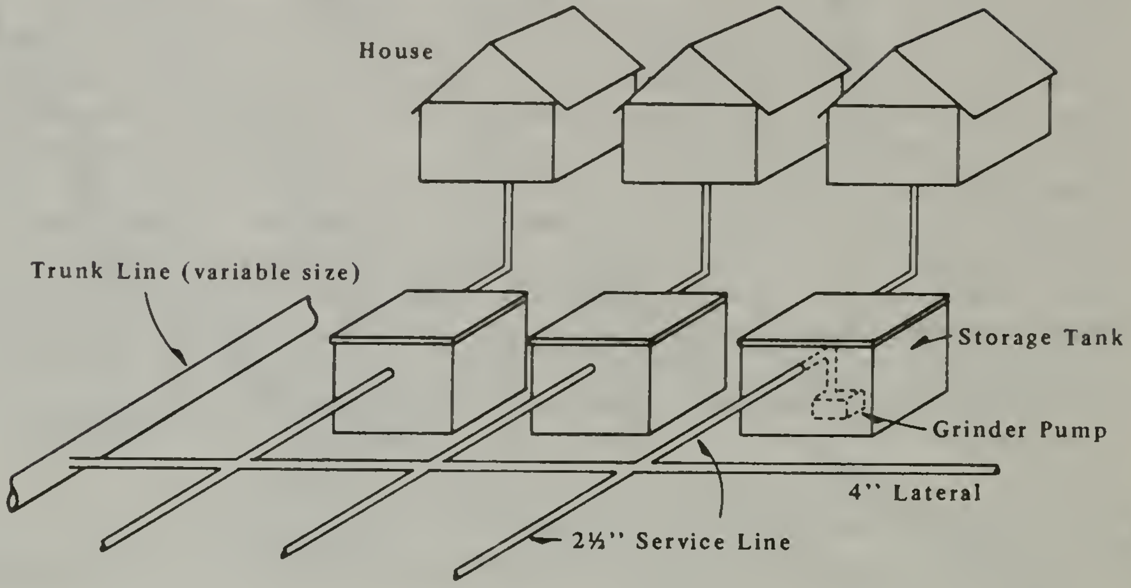
iii) Pressure Sewer with Grinder Pumps

This system is similar to the small-diameter pressure sewer system discussed above, but utilizes a grinder pump rather than a septic tank and effluent pump. The grinder pump cuts and grinds the solids within the sewage, reducing it to a slurry for pumping. Since grinder pumps are more costly than effluent pumps, the installation of such a system may be more expensive than a septic tank effluent pumping system with grinder pumps. However, when life cycle costs including septic tank pumping are considered, grinder pump systems may be competitive. These systems are used in rolling terrain or in individual cases where a typical gravity service cannot be used for a particular unit. A typical pressure sewer system is illustrated in Figure 12.

3. LIFT STATIONS

The principal conditions and factors necessitating the use of lift stations in a wastewater collection system include the following: a) The elevation of the area to be served is too low to be drained by gravity to existing or proposed trunk sewers; b) Service is required for areas that are outside the natural drainage area but within the sewage dis-

Figure 12. Pressure Sewer System with Grinder Pump



trict; and c) The omission of pumping, although possible, would require excessive construction costs because of the deep cuts required for the installation of a trunk sewer to drain the area.

Lift stations are expensive to install, require periodic inspection and maintenance, and strain public relations if they malfunction and allow backup of domestic wastes into residences or businesses. For these reasons, they should be avoided whenever possible by recognizing sewer planning and treatment plant location in municipal land use zoning and comprehensive planning.

The type of lift station that is appropriate usually depends on the incoming flows. Generally, higher flows necessitate a more sophisticated and expensive station than low flows. Regardless of the flow, however, all sewage lift stations should be designed to incorporate the following protective provisions: a) a minimum of two pumps, each of which can handle the anticipated peak flow; b) an alarm system to notify officials of a malfunction or power outage at the station; and c) a standby power source, usually an alternate power feed or an auxiliary generator that can be utilized to operate the station during a power outage.

Generally, there are three basic types of collection system lift stations in use in Montana. These include pneumatic ejectors for very low flows, wet well stations for moderate flows, and wet well/dry well stations for larger flows. A brief description of these basic types of lift stations is included herein.

a. Pneumatic Ejectors

Pneumatic ejectors are commercially available for pumping flows not exceeding about 100 gpm. They have the important advantage of being able to handle unscreened domestic wastewater without clogging. (Although low-capacity pumps can be employed, the smallest centrifugal pump designed to pass three-inch solids and operate with reasonable freedom from clogging has a rated capacity greater than 100 gpm.) The essential components of a pneumatic ejector are an air compressor, wastewater receiving chamber, piping with appropriate valves, and automatic controls for operation. Typically, wastewater flows by gravity into an enclosed receiving chamber where it displaces air through a vent. When the receiver fills, an electrical control system shuts off the vent connection and supplies compressed air to the chamber. The pressure closes the inlet check valve and forces the wastewater through a discharge check valve in the outlet pipe. After it is emptied, the chamber is again vented, allowing wastewater to flow in while the outlet check valve shuts, preventing the backflow of ejected wastewater.

b. Wet Well

Wet well pumping stations are often installed for small applications with peak flows between 100 and 300 gpm. They can be mounted directly over an enlarged manhole to provide a compact, low-cost lift station. The pumps that are most often used are submersible pumps with close-coupled submersible motors or long-shaft centrifugals with the motors mounted on a slab above the wet well. In most instances, submersible motor pumps are hung on rails so that they can be hoisted out of the manholes for maintenance. Pump control devices usually hang in the wet well, and consist of float switches that are preset according to a specific liquid level. The master control panel should be located at the ground surface, and should be enclosed in a lockable cabinet if there is no building at the site. Discharge valves and necessary appurtenances should be located in a separate valve pit immediately adjacent to the wet well. At the present time, several manufacturers market "package" lift stations of various sizes and capacities. In many instances, these package units may be appropriate and economical; however, a custom-designed lift station may be required for certain situations.

c. Wet Well/Dry Well

For larger flows, pumping stations with separate wet and dry wells are preferred to wet well mounted lift stations and should be utilized if at all possible. In this type of lift station, the wastewater initially passes through a bar screen or rock basket designed for periodic cleaning. Sewage pumps and all necessary controls are located in the dry well, and each pump has its own suction pipe to the wet well. The dry well should be designed with a sump to pump seepage and washdown water back to the wet well. This type of station offers the obvious advantage of better access to the mechanical equipment involved. Pre-manufactured "package" lift stations of this type are also available.

C. Treatment Systems

1. INTRODUCTION

The primary purpose of wastewater treatment is to protect the health and well being of the community. The extent or completeness of treatment necessary to accomplish this purpose is governed by state and federal regulations as well as the location and physical constraints of an area.

The primary objectives of wastewater treatment include:

- Prevention of disease;
- Prevention of nuisances;
- Avoidance of water supply contamination;
- Avoidance of silting navigable waters;
- Maintenance of clean waters for the propagation and survival of fish;
- Maintenance of clean waters for bathing and recreation; and
- Conservation of water for all uses.

Although the quality of effluent required to achieve these objectives generally is fixed, the volume and the physical, chemical and biological characteristics of the treatment plant influent are constantly changing. These changes may be relatively short-term changes of a seasonal, monthly, weekly, or daily nature. Alternatively, they may be long-term changes arising from basic alterations in the population distribution, social characteristics, economy, or industrial production and technology of the plant service area. In both cases, the health and well-being of the community depend on the ability of the operator to respond to change, recognize potential treatment problems, and institute corrective actions if necessary. This demands a thorough knowledge of the treatment facility and process.

2. ALTERNATE TREATMENT PROCESSES

Typically there are numerous substances and organisms found in the municipal wastewater stream. These include: a) infectious worm,

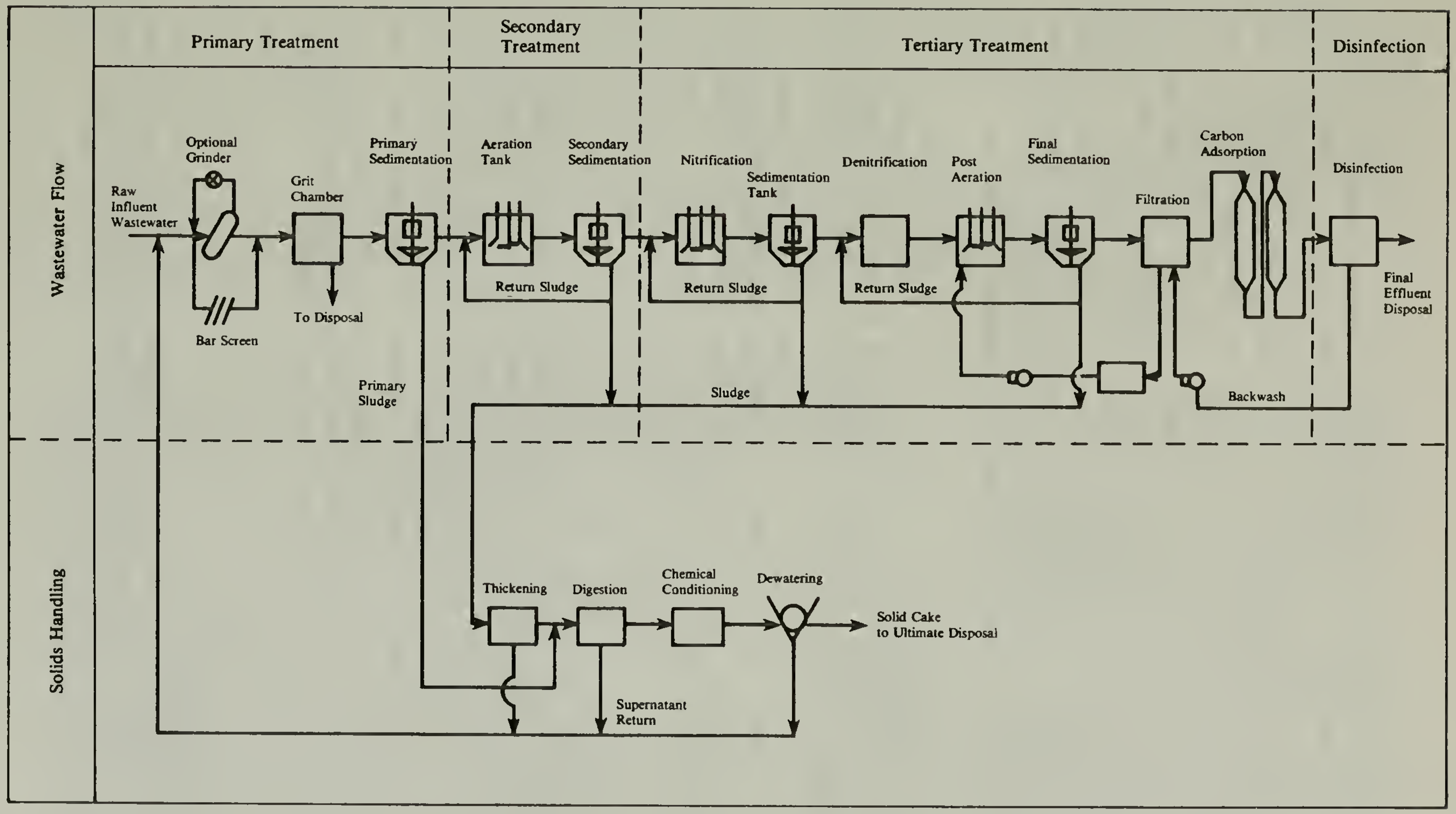


Figure 13. Flow Diagram of Basic Wastewater Treatment Process

protozoan, bacteria and virus organisms; b) oxygen-demanding wastes such as carbohydrates, fats and proteins; c) plant nutrients such as ammonia and phosphates; d) organic chemicals such as pesticides; e) inorganic chemicals such as heavy metals; and f) sediment such as silt and sand. To achieve a desired level of treatment, a number of different processes may be necessary. In general, the higher the wastewater flows, the most complex the treatment plant must be. For smaller communities, a multiple-cell lagoon system will usually suffice to meet treatment requirements. When lagoon systems are impractical due to insufficient land area, unsuitable hydrogeologic conditions, cost-effectiveness or a combination of all three, a mechanical treatment plant may be more practical. Described in this section are the basic treatment processes that may be applicable for various communities in Montana. Figure 13 contains a general flow diagram of these processes.

a. Preliminary Treatment

Preliminary treatment consists of removing materials that may damage pumps and treatment process equipment downstream. Preliminary treatment usually consists of a bar screen to remove large materials, debris, rags, etc. In some instances, a grinder (comminutor) may also be utilized to shred such materials. Preliminary treatment also involves the removal of rocks, sand, silt, etc. by passing the wastewater through a grit chamber.

b. Primary Treatment

Primary treatment consists of removing the initial settleable and floatable materials from the untreated wastewater. This is typically accomplished in a large settling tank usually equipped with surface skimming and sludge collection devices. In this tank, approximately 20 to 40 percent of the organic materials and as much as 60 percent of the solids are removed under quiescent conditions. However, colloidal solids and dissolved solids usually will not be removed. Therefore, primary processes generally must be supplemented by secondary, and possibly tertiary treatment to achieve the desired pollutant removals.

c. Secondary Treatment

The basic objective of secondary treatment is to reduce the concentration of organic matter in wastewater. This can be accomplished by either biological or physical-chemical processes. These processes are briefly described in the following narrative.

i) Biological Treatment

This process involves the culture and growth of microorganisms in the primary-treated sewage in the presence of oxygen (aerobic conditions). The microorganisms utilize the organic material in the sewage for food; this results in the growth of more microorganisms and a consequent decrease in the organic content of the sewage. Treated wastewater is separated from the microorganisms in settling tanks normally referred to as "secondary" or "final" clarifiers. This treated liquid portion, after passing through the final settling process, is then typically disinfected and discharged to a stream or river. This secondary process will usually remove 85 to 95 percent of both the organic material and remaining suspended solids in the wastewater.

A portion of the biological solids (secondary sludge) that are collected in the final clarifier are recycled back to the head of the secondary treatment process to foster additional microbial growth. The remainder of the solids is wasted to a sludge handling system. Because of the extremely high moisture content of the waste secondary sludge (approximately 98%) and the abundance of pathogenic organisms it may contain, further treatment of the sludge prior to disposal is usually required. These treatment processes are discussed later in this chapter.

ii) Physical-Chemical Treatment

Although there are many different possible combinations of unit processes, all the different approaches to physical-chemical treatment include the same basic unit processes of coagulation, sedimentation, filtration, and carbon adsorption. Some systems include a nitrogen removal process. Fine screens also have been used for effluent polishing. The combination of processes selected depends on the wastewater quality and on the desired effluent. Usually, the basic unit processes must be preceded by standard pretreatment such as coarse screening, grinding, and grit removal. Removal of the larger solids is also critical for both chemical dosage and for filtration considerations.

d. Tertiary Treatment

Tertiary waste treatment is not typical in Montana, but may be required to reduce the concentrations of inorganic and/or organic constituents of the waste below the concentrations achievable through primary and secondary treatment. When discharge conditions warrant, tertiary treatment processes are also utilized to remove heavy metals and other elements such as nitrogen and phosphorus. Tertiary treatment may include various physical, chemical, and/or biological processes, depending on the conditions in the area and the particular treatment problem involved.

e. Disinfection

Disinfection systems are primarily used to destroy pathogenic bacteria, viruses, and amoebic cysts commonly found in wastewater. Pathogens may cause serious outbreaks of waterborne diseases such as typhoid, cholera, paratyphoid, bacillary, dysentery, polio and infectious hepatitis. In Montana, the need for disinfection arises on a case-by-case basis and is based on the condition and use of the stream or river into which the wastewater is discharged. Currently, all wastewater treatment facilities in the state where disinfection is required utilize chlorination processes. Recently, however, ultraviolet disinfection facilities have become increasingly popular throughout the country. The first ultraviolet system for wastewater disinfection in Montana will go on-line in 1984.

A recent policy decision by the MDHES Water Quality Bureau exempts certain facilities from disinfection requirements during the winter months when human contact such as swimming in the receiving watercourse is unlikely. Cases are reviewed individually for this exemption.

f. Sludge Treatment and Disposal

Sludge refers to the settled solids accumulated and subsequently separated from the liquid stream during various phases of wastewater treatment. Sludge handling and disposal can be one of the most difficult and costly parts of the wastewater treatment process.

The name given to a particular sludge usually describes the source or condition of the sludge. Examples of this include: primary sludge, secondary sludge, waste-activated sludge, chemical sludge, raw sludge, digested sludge, and dewatered sludge. The characteristics of each of these sludges are quite different, requiring unique stabilization, conditioning, reduction, and disposal techniques.

Sludge stabilization, or digestion, is defined as the biological, chemical or thermal decomposition of putrescible organic solids and pathogens from primary, secondary or tertiary processes. This is often accomplished biologically under anaerobic or aerobic conditions.

Anaerobic digestion takes place in the absence of free oxygen and relies on specialized microorganisms that function in that environment. The solid end product of anaerobic digestion is relatively nonputrescible and inoffensive. The off-gas produced contains about 65 percent methane, which may be collected and burned as a fuel.

Aerobic digestion takes place in the presence of free oxygen. During digestion, biologically degradable organic matter is oxidized by microorganisms to form carbon dioxide, water, and ammonia. As digestion proceeds, the ammonia is converted to nitrates. The solid residue remaining is odorless and humus-like.

Before final disposal of the sludge, it is often desirable to further reduce the volume and weight of sludge and to change it from a liquid that is more than 95 percent water to a handleable semi-solid form that is approximately 70 percent water. Dewatering may be accomplished by using drying beds, vacuum filters, centrifuges, or filter presses. The most popular method to dewater sludge from smaller communities has been the use of sand-covered drying beds. In this process, sludge is applied to the beds during the spring, summer and fall months and stored in the digesters or aerated basins during the winter. It usually takes approximately 30 days to reduce the moisture content of the sludge to approximately 70 percent. Once the sludge has been dried to this level, it is usually disposed of by landfilling or as an agricultural soil conditioner.

Within the past few years, two additional sludge management concepts have been utilized in Montana. One concept, which is being used in Helena and Kalispell, is sludge injection. The digested sludge is injected into soil on agricultural fields utilizing a specially designed injection vehicle. Sludge is stored in the digesters during the winter and is applied to the soil during the remainder of the year. This concept does not require any intermediate drying process. The second concept is sludge dewatering using the vacuum drying bed process. Sludge is applied to a drying bed constructed of porous blocks. A vacuum pump in place under the bed is then utilized to pull the moisture out of the sludge. This concept is not as dependent on weather conditions as the sand drying bed system. Therefore, the drying cycle takes only about 24 hours, and can continue year-round if the vacuum drying beds are enclosed in a building. Currently, the city of Chinook is constructing the first vacuum drying bed in the state.

3. TYPICAL TREATMENT FACILITIES IN MONTANA

There are approximately 176 communities in Montana that are currently served by some type of municipal wastewater treatment facility. The total population served by these facilities is estimated to be 370,000, which represents approximately one-half of the total population of the state. In addition to the 176 municipal systems in operation, several communities are currently planning or designing central wastewater collection and treatment systems.

Most of the wastewater treatment facilities in Montana can be categorized as one of the following four general types: a) stabilization ponds, or lagoons; b) conventional activated sludge plants; c) oxidation ditch plants; or d) extended aeration plants. There are ten additional plants in Montana that utilize a variety of other processes. Included herein is a brief description of the processes utilized within the state.

a. Stabilization Ponds

Stabilization ponds (lagoons) are the most common type of treatment facility in Montana. Currently, 137 communities in the state utilize lagoons to treat their wastewater. Lagoons generally consist of earthen basins open to the air, and depend on natural biological, chemical and physical processes to stabilize and treat wastewater. In a lagoon, the settleable solids in the wastewater fall to the bottom where they decompose under predominantly anaerobic conditions. The products of sludge decomposition, together with the influent dissolved and suspended solids, furnish food for the aerobic bacteria. These aerobic bacteria correspondingly degrade the organic contaminants in the wastewater.

In order for the lagoon treatment process to work, the aerobic bacteria must receive oxygen. In 120 of the 137 lagoon facilities in the state, no supplemental mechanical means of aeration is provided in the lagoon. Oxygen is replenished in the water through a combination of diffusion at the water surface, mixing from wave action, and photosynthesis by algae. This type of lagoon is commonly referred to as a facultative lagoon. According to current state standards, all new facultative lagoons must have at least two cells, and must have three cells if the effluent is discharged to a watercourse. In most cases, facultative lagoons must be sized to provide 180 days of detention.

Where insufficient land is available for the construction of facultative lagoons, many communities have chosen to construct aerated lagoons. There are 17 such facilities in operation in the state at the present time. An aerated lagoon does not depend on natural processes to furnish the necessary oxygen for bacterial respiration, but instead uses mechanical or diffused aeration equipment. When aeration equipment is utilized, pond depths are typically 10 to 15 feet compared to average pond depths of 3 to 5 feet for facultative lagoons. Therefore, only about one-third as much land area is required for the construction of aerated lagoons. Because the aeration causes vigorous mixing of the lagoon contents, separate non-aerated zones or cells must be used to settle the wastewater prior to discharge.

According to state and federal wastewater regulations, there are four methods allowed for discharging treated wastewater from a lagoon facility. These include the following.

i) Continuous Discharge

Wastewater is discharged continuously to a stream or river throughout the year with no imposed constraints on the time of discharge. All ponds usually remain at full depth, and discharge occurs over a level control device. The pond volumes are relatively constant throughout the year.

ii) Controlled Discharge

Wastewater is intermittently discharged to a stream or river over a short period of time after wastewater has been treated and stored. The time of discharge is chosen when the pond characteristics are compatible with the receiving water and waste discharge permit requirements.

iii) Land Application

Wastewater is disposed of by applying it to land so that there is no discharge to surface water. This disposal method may include flood, spray, or overland flow irrigation, or infiltration/percolation basins. The wastewater treatment pond criteria for land application is basically the same, regardless of the land application disposal method chosen. This method of wastewater disposal is commonly used when discharge is impractical, and agricultural land is available for application.

iv) Complete Retention

Wastewater is disposed of by evaporation and/or seepage so there is no discharge to surface water. The net evaporation rates are calculated using the mean annual lake evaporation rate and the ten-year frequency precipitation rate of the area. The net loss for pond sizing also includes the allowable annual seepage rate for the pond site.

The primary determining factor in the choice of stabilization ponds versus other waste treatment processes such as package or conventional treatment plants is the availability of land in relatively close proximity to the community. There are, however, other factors that must be weighed. Summarized below are the primary advantages and disadvantages of utilizing stabilization ponds compared to other treatment processes:

ADVANTAGES

- Simple to operate;
- Less subject to process disruptions due to variations in hydraulic and/or organic loading than mechanical wastewater treatment systems;
- Cost less to operate and maintain than mechanical treatment systems; and
- In general, for smaller communities they have a lower capital cost than mechanical treatment systems.

DISADVANTAGES

- Require larger land areas than mechanical treatment systems;
- Subject to seasonal variations in performance which in turn necessitate storage and intermittent discharges; and
- May emit nuisance odors if not properly designed and operated.

b. Conventional Activated Sludge Plants

The activated sludge process was developed in England in 1913. It involves mixing microorganisms under aerobic conditions with liquid wastes that have undergone primary clarification. This mixture of microorganisms, organic matter and inorganic matter is combined in an aeration basin until the organisms have utilized most of the available organics. Aeration is typically accomplished with air blowers and submerged diffusers. After approximately four to eight hours of aeration, the flow enters final settling tanks. The effluent from the settling tanks is discharged as final effluent and the solids that settle are pumped back to the aeration basin. This recycle of solids is continuous. To compensate for the increase in solids that occurs due to microbial growth, a small portion of the sludge is wasted to a digester from the system continually.

For large-scale installations, the activated sludge process is very efficient and is generally the most economical. However, it requires considerable operational control and is therefore best suited to large communities that can afford full-time operating and maintenance staff.

At the present time, ten communities in the state utilize the activated sludge treatment process. These communities are generally some of the larger cities in the state, and include Billings, Great Falls, Missoula, Bozeman, Butte, and Havre. In addition, the smaller communities of Ekalaka, Harlem, Galen and Hot Springs utilize similar processes on a much smaller scale. The facilities in Harlem and Galen are package plants that were constructed approximately 30 years ago and are scheduled for replacement.

c. Oxidation Ditch Plants

The oxidation ditch sewage treatment process was developed in Holland in the early 1950s. The process is a modification of the activated sludge process, using suspended microorganisms to remove the organic material from sewage. Primary clarification is not required as part of oxidation ditch systems. Screened sewage is added directly to the oxidation ditch, which is oval in shape and normally has a rectangular or trapezoidal cross section of shallow depth. Typically, two rotors are used to circulate and oxygenate the water in the ditch. These rotors are large circular rotating brushes that are partially submerged in the ditch. The sewage-microorganism mixture from the ditch, after approximately 24 hours of aeration, enters a clarifier where the solids settle and clarified liquid is discharged as final effluent. Most of the solids that settle in the clarifier are recycled back to the ditch and the remainder of the solids are pumped to a sludge digester. Oxidation ditch systems, because of the long aeration times required, are usually not economical for large-scale installations and are therefore used mostly by smaller communities. They are relatively easy to operate and are not as subject to upsets as activated sludge systems. The quantities of sludge produced by oxidation ditches are comparatively less than for conventional activated sludge systems, so sludge treatment and disposal costs are less.

Currently, there are six oxidation ditch treatment facilities in operation in Montana. These are located in Colstrip, Forsyth, Hardin, Poplar, Miles City, and Stevensville. Two additional facilities at Hamilton and Chinook are under construction at this time.

d. Extended Aeration Plant

The extended aeration plant process is another modification of the activated sludge process and is very similar to the oxidation ditch process. Primary treatment is not normally provided at extended aeration plants. Screened and/or comminuted sewage is normally mixed and aerated for 18 to 30 hours in one or several aeration basins. Submerged diffusers served by air blowers typically provide aeration. Discharge is to a final clarifier where the solids settle and the clarified liquid is discharged as final effluent. As with the activated sludge and oxidation ditch processes, the settled solids are recycled back to the aeration basin and excess solids are pumped to a digester.

The long aeration time required for the extended aeration process makes it an uneconomical method of sewage treatment for larger communities. However, the process is relatively easy to operate and produces less sludge than the activated sludge process. It is therefore useful in small to medium-sized communities.

Currently there are eleven extended aeration plants in operation in the state. With the exception of the plant recently constructed in Columbia Falls, all these facilities serve relatively small populations. Some of the smaller communities that utilize these systems include Highwood, Hinsdale, and Willow Creek.

e. Other Treatment Facilities

In addition to the treatment facilities discussed herein, there are eight communities in the state that utilize various other waste treatment processes. These communities and their corresponding treatment processes are summarized as follows:

Community	Type of Treatment
Helena Kalispell	Activated Bio-filter
Livingston Laurel	Rotating Biological Contactors (RBC)
Bigfork Canyon Ferry Bonner	Trickling Filter
Lolo	Contact Stabilization Package Plant

With the exception of the RBC plants in Livingston and Laurel, which are quite new, little interest has been demonstrated recently in the other three treatment processes. Trickling filters were once widely accepted in Montana and nationwide as an appropriate and economical secondary process for smaller treatment facilities. Although a number of them remain in satisfactory usage, no new construction of this type is currently planned in the state. These systems use a rock-filled basin as a growth media for a biological film; wastewater is sprayed ("trickled") over the rocks by a rotary arm, and the organisms in the film consume organic materials. The porosity of the rock bed, especially the upper layers, allows free air exchange for oxygenation. A final clarifier is used to settle remaining or sloughed solids from the effluent before it is discharged. These systems can be loaded at varying rates and can be quite effective, although newer biological film systems such as RBC's are more popular now.

The RBC process consists of a series of closely spaced discs anchored to a shaft that is supported just above the surface of the waste to be treated. The lower portion of each disc extends into the sewage while the upper portion of the disc rotates in the air. A biological growth or film attaches to the disc and this biological film is alternately submerged in the sewage to absorb organics and then raised out of the sewage to absorb oxygen. The disc rotates slowly, typically at one revolution per minute.

Sewage usually undergoes some form of primary treatment prior to discharge to RBC units. Effluent from the RBC units goes to a secondary clarifier where biological solids are allowed to settle and the clear liquid is decanted and discharged as treated sewage effluent. The advantages of RBC plants are that they are relatively easy to operate and are less subject to upsets than activated sludge plants. Economics, however, appear to favor smaller RBC plants rather than large-scale installations.

D. Operation and Maintenance

1. COLLECTION SYSTEM MAINTENANCE

Serious and expensive problems can result from the improper maintenance of wastewater collection systems. The key to proper maintenance of sewage systems is maintaining and upgrading maps that show the locations of mains, manholes, flushing inlets, service connections and other appurtenances as well as planning a preventative maintenance schedule that incorporates an effective recordkeeping system. Records should be kept on all maintenance performed, with particular emphasis placed on troublesome lines that require more frequent inspection and/or cleaning.

Sewer stoppages are usually caused by sand, greasy materials, sticks, stones, and tree roots. Common cleaning techniques include flushing with water, scraping with mechanical tools, hydraulic scouring with high-pressure jets, and the addition of chemicals. Periodic flushing helps to keep lines clear, and is often performed in association with inspection. The usual flushing procedure is to insert a high pressure water hose ("sewer jet") into the sewer through a manhole. This is most advantageous in cleaning lines in residential sections that do not have sufficient connections to provide cleansing flows of wastewater. Flushing has limitations, however, since it merely moves debris from one section of sewer to another.

In some instances, a power rodding machine may be necessary to clear or unclog a sewer line. Most such machines utilize a trailer unit that includes a reel holding several hundred feet of rod. The rods are fed through the sewer main using an engine-driven mechanism with variable speed control. A number of various tools may be used, depending on the circumstances. A rotating blade cutter may be pulled through a sewer to cut grease and roots, or a root saw may be pushed through the pipe to accomplish the same thing. An auger or corkscrew may also be used to remove large objects. In addition, there are porcupine scrapers, spearheads, hole openers, and other appurtenances for specific applications.

In addition to mechanical rodders, a bucket machine may be necessary to clean grit from sewer mains. A bucket machine utilizes two power winches located over adjacent manholes with cable connected to both ends of a cleaning bucket. The cable is initially threaded through the pipeline using a power rodder or floating cone. Connecting cables fastened to the bucket ride over surface-hung manhole rollers so that the bucket can be pulled in either direction by the machine at the appropriate end. The bucket is pulled through the sewer until it is loaded with debris. A chute at the discharge manhole is used to load the grit directly onto a truck. A power winch and cable can also pull a porcupine scraper or sewer ball through a pipe to clear a line.

In some instances, a hydraulically propelled sewer cleaning tool may also be useful to clean sewers. This tool depends on water pressure to provide cleaning force and propulsion. The unit is attached to the end of a truck-mounted hose reel that can supply water under high pressure. Action of the backward-pointing jets moves the nozzle forward, pulling the hose behind it. Debris is then flushed back to the inlet manhole where it can be removed hydraulically.

In some instances, the use of chemicals may be advantageous for the control of tree roots. Routine use of copper sulfate for this purpose has been quite successful in many instances. Periodic dosages may be added at manholes or through residential water closets. The amount required is determined by trial and error, and experience.

In addition to the cleaning and unplugging of lines, a successful sewage system maintenance program should include regular sewer line inspections. Several techniques may be used to perform this inspection. Low-pressure smoke detection can help locate openings in a pipeline, service connections left unplugged from houses that have been removed, cross-connections with the storm sewer, and unauthorized drainage connections. Dyes or other tracer chemicals may also be used to locate extraneous infiltration or exfiltration points. While large sewers allow visual inspection, the inside of small-diameter pipes may require photographing or closed-circuit television inspection. Skid-mounted cameras can be drawn through lines to observe existing conditions. Most small cities find it more economical to contract for services to perform this specialized inspection; larger communities usually purchase the equipment and perform the inspection services themselves.

Visual inspections should be conducted each year. Other inspections such as TV inspection should be done every five to ten years.

2. INFILTRATION AND INFLOW

Entrance of extraneous waters into sewer systems is of concern for several reasons. These include sewer surcharging during periods of intensive rainfall resulting in flooded basements, overloading of treatment plant facilities, overtaxing of pumping stations, excessive costs in processing diluted wastewater flows, and health hazards from discharging raw wastewater. In the past, problems of excessive infiltration and inflow were often handled by construction of relief sewers that bypassed treatment works and flowed directly to surface watercourses. This practice allowed adequate waste treatment 90 to 95 percent of the time, and appeared at the time to be the best economical choice. However, the objective of new federal legislation is to eliminate these pollutional discharges by requiring treatment of all waste flows even during peak periods, and this practice has been discontinued.

Infiltration results from groundwater entering sewer lines through poor joints and cracks in manholes and sewer pipe; the sources are widespread, and the flow is relatively steady during times of high groundwater levels. Inflow comes from direct connections such as roof drains, and results in sudden high rates of flow of short duration. The quantity of infiltration-inflow is considered to be the maximum wastewater flow minus the peak domestic and industrial discharge. A systematic approach to sewer system evaluation includes identifying the quantity and nature of infiltration-inflow, isolating problem areas, and then evaluating the most economical corrective measures. The basic alternatives are either to rehabilitate the sewer system to reduce extraneous flows, or to extend treatment facilities to handle peak wet-weather flows.

When infiltration and/or inflow problems are suspected, the first step generally is to analyze and identify the magnitude of the problem. The sewer system is usually divided into areas that drain to key points, such as a manhole or pumping station. Flow monitoring is then conducted to determine peak discharges. Evaluation of this data then reveals whether infiltration and inflow are reasonable. Detailed field investigations are then conducted in those areas where flows are considered excessive. This additional analysis should uncover the deficiencies that are not obvious from cursory inspections and flow monitoring.

Once all surveys and field work have been completed, a final analysis should be prepared. This analysis should present the findings of the investigations as well as the recommendations for a sewer rehabilitation program and, most important, an economic evaluation of the problem. Expenses of rehabilitation should be compared to the costs of expanding treatment works to process extraneous water. Decisions should also be made regarding the feasibility of repairing different sections of the collection system. Sewer repair may involve replacing pipelines, repairing structural deterioration or defects, or sealing openings by external grouting or pipe relining. The most economic and best techniques must be determined from local conditions and experience.

3. WASTEWATER TREATMENT FACILITY OPERATION AND MAINTENANCE

The operation and maintenance of a wastewater treatment facility is highly dependent on the type and complexity of the facility. Obviously, the operation of a sophisticated mechanical treatment facility is considerably more time consuming and complex than the operation of a stabilization pond facility. Likewise, maintenance requirements increase according to the amount of mechanical equipment present and the complexity of the treatment process. Regardless of the type of treatment facility, however, the individuals who are responsible for operations should be thoroughly familiar with all components of the facility and should understand how each component affects overall treatment process performance. To insure that the degree of treatment is satisfactory, the operators should also be familiar with all applicable local, state and federal regulatory and monitoring requirements. In addition, regulations require that each treatment facility, regardless of type, must be operated by an individual who is licensed as a wastewater treatment plant operator in Montana.

In addition to these responsibilities, it is very important that all wastewater plant operators maintain complete and accurate records of all phases of the facility's operation and maintenance. In many cases, extensive records are filed daily, but are not reviewed until the facility is having serious operational problems or requires expansion or improvement. More commonly, however, testing and flow data is not recorded often enough to effectively evaluate the facility's performance. An effective sampling and testing program is one that includes continuous evaluation. The data collected should be applied to calculate existing hydraulic and organic loadings on the various processes, and to pinpoint problem areas in operations that are related to a change in inflow characteristics such as industrial waste loadings or inflow/infiltration.

Effective maintenance is essential to the successful operation of a wastewater treatment plant as well the minimization of undue repair expenditures and process downtime. A proper attitude toward maintenance must be instilled in operating personnel, and preventative rather than remedial maintenance should be the focus. Proper schedules, thorough records, and an adequate inventory of spare parts are essential to effective maintenance management. Neglect of proper maintenance is inexcusable, recognizing the tremendous capital expense involved in a community's wastewater treatment plant and the serious ramifications of breakdowns.

Finally, it is very important to the overall performance of a wastewater facility that the operators be well trained and experienced. Regardless of the sophistication built into a facility, the overall key to its performance lies in the experience, ability and attitude of the operators. An adequate staff for a wastewater treatment plant, both in terms of numbers of personnel and expertise, is essential. Communities that try to skimp on staffing or operator qualifications are guilty of false economy. An experienced operator can often detect potential problems that might upset the operation of the plant or cause major damage to one or more mechanical components. Such early detection can usually avert numerous problems and often can save considerable time and money for the local municipality. Because of these factors, it is sensible as well as cost-effective for municipalities to finance and encourage their treatment plant operators to attend seminars and training courses to further their background in and understanding of wastewater treatment.

REFERENCES FOR PART V

1. Mark J. Hammer, Water and Wastewater Technology.
2. Homer W. Parker, Wastewater System Engineering.
3. Operation of Wastewater Treatment Plants, Water Pollution Control Federation.
4. Wastewater Treatment Facilities for Sewered Small Communities, Environmental Protection Agency.
5. Metcalf and Eddy, Inc., Wastewater Engineering.
6. Planning Wastewater Management Facilities for Small Communities, Environmental Protection Agency.
7. Alternatives for Small Wastewater Treatment Systems, Environmental Protection Agency.
8. Recommended Standards for Sewage Works, 1976 Edition, Great Lakes - Upper Mississippi River Board of Sanitary Engineers.
9. Wastewater Treatment Pond Design Calculations, Montana Department of Health and Environmental Sciences.

Part VI: Regulations and Requirements

A. Introduction

Governmental regulations regarding water and sewer systems influence the decision-making process for local communities throughout the planning, design, construction, and operational stages of the systems. These regulations have been established to protect the public health and meet national and state goals regarding water quality and the overall protection and enhancement of the environment. Due to the large commitment of financial resources necessary to meet this goal, it is important that investments be efficient, cost-effective, and in many cases innovative. Numerous federal and state agencies have been empowered with regulations in an effort to meet these requirements. Local governments must finance, operate, and maintain approved facilities under these constraints.

This chapter is intended to familiarize local administrators with the important federal and state regulations, regulatory agencies and their functions, and the major requirements for operators of water and wastewater treatment facilities. It should be noted that information presented in this chapter is briefly summarized, and additional details regarding the specific program requirements or legislation may be obtained from the appropriate federal and state agencies.

B. Regulatory Agencies and Functions

The primary responsibility for the administration and enforcement of regulations regarding public water and sewer systems within Montana lies with: 1) the Environmental Protection Agency; 2) the Water Quality Bureau of the Montana Department of Health and Environmental Sciences; and 3) the Public Service Commission. The following narrative outlines the basic functions and responsibilities of each agency.

1. ENVIRONMENTAL PROTECTION AGENCY

The United States Environmental Protection Agency (EPA) was created in 1970 because of increased public and governmental awareness about the deterioration of the natural environment and the dangers of pollution to the health and welfare of all Americans. The EPA operates a range of programs that include research, technical analysis, standard-setting and enforcement. In addition, the EPA makes grants available to state and local environmental agencies to implement programs and to communities for actual facility improvements. Basic responsibilities of the EPA with regard to water and sewer projects are to:

- Provide assistance to states in developing effective programs for the implementation of federal guidelines concerning sewer and water programs;
- Provide technical assistance and training materials and programs to states and local communities;
- Support and encourage continuing research and development efforts in the fields of water and wastewater management;
- Review state water and sewer programs and provide support to such programs;
- Review and revise regulations regarding water and wastewater; and
- Assume the primary responsibility for enforcement of federal regulations if states do not enforce them.

Much of the authority and enforcement responsibilities of the EPA have been delegated to state agencies. Since state governments administer federal programs concerning water and sewer projects, this transfer of power allows state governments to be more responsive to local governments and exercise more control over the performance of water and wastewater facilities. In Montana, nearly all EPA programs have been delegated to MDHES.

2. MDHES/WATER QUALITY BUREAU

The Montana Department of Health and Environmental Sciences (MDHES) was created during the executive reorganization process that occurred during 1971. Reorganization allowed the Department of Health and Environmental Sciences to become a separate executive unit with its own distinct functions and powers. The MDHES responsibilities toward water and sewer projects are to:

- Adopt regulations at least as stringent as those set down by the U.S. Environmental Protection Agency (required to participate in delegated programs);
- Provide technical assistance, training, and support to local agencies;

- Review and approve local planning efforts and plans and specifications;
- Provide consumer information regarding federal, state and local regulations;
- Carry out water quality monitoring and research;
- Compile records and reports submitted by local utilities;
- Adopt criteria for laboratory certification and certify laboratories;
- Provide for variances and exemptions; and
- Provide planning for emergency circumstances.

The Water Quality Bureau of MDHES is responsible for all functions of the Department regarding matters of water pollution. With respect to wastewater management, these functions involve the administration and enforcement of the Montana Water Pollution Control Act, the Montana Pollutant Discharge Elimination Permit Program, and state subdivision regulations. With respect to public water supplies, these functions include administration and enforcement of the Montana Public Water Supply Law and state subdivision regulations. Additional detail regarding these programs and regulations is presented later in this chapter.

MDHES is aided in its determination of policy guidance on issues regarding water pollution by the Water Pollution Control Advisory Council. The Council is comprised of eight members appointed by the Governor and the directors of several state departments. State and local government, industry, agriculture, recreation, and fish and wildlife interests are represented by the membership of the Council.

The MDHES maintains a Legal Division to assist in the development of statutes for water quality matters. This Division also handles enforcement actions relating to water quality violations.

Education and certification of water and wastewater system operators within the state is another function of MDHES. Operator training courses are regularly scheduled across the state to help candidates prepare for certification tests and to allow operators to continue their education. Distinct certifications are granted for water distribution system, water treatment plant, wastewater treatment plant, and industrial wastewater treatment facility operators. Within these categories, different certification classifications are also issued, depending on the type of process involved and/or the population served. All operator certifications involve a fee and examination procedure.

3. PUBLIC SERVICE COMMISSION

The Utility Division of the Public Service Commission (PSC) is responsible for the regulation of municipal water and sewer utilities to provide reliable and adequate services at the lowest achievable cost to consumers while providing the municipal operator with a fair and reasonable compensation for services rendered. State regulations require that the PSC review rate increases larger than 12 percent per year. These rate increases are most likely attributable to construction of new facilities or major improvements to existing systems, irrespective of percentage. PSC review is not necessary if the rate increase is to fund capital improvements mandated by federal or state authorities to assure compliance with legal requirements.

For rate increases larger than 12 percent and not mandated by an appropriate agency, an application for the increase must be filed with the PSC. This application must include the following items:

* A petition indicating that a rate change is needed;
* A copy of the proposed rate schedule;
* A resolution from the local government authorizing the petition;
* A narrative detailing the reasons for the rate change, a comparison of present and proposed rates, and an estimate of anticipated revenues;
* Cost justification for the increase; and
* A filing fee.

After this information is submitted and reviewed by staff personnel, the rate increase evidence is presented to the Commission for acceptance. At this point, comment on the proposed increase is solicited through public hearing procedures. The five-member Commission must then issue a decision based on the review of evidence and public comments obtained during the public hearing. The Public Service Commission may changes its original decision if information obtained through rehearing or appeal procedures dictates the need for change or modification.

C. Federal Regulations and Guidelines

1. THE SAFE DRINKING WATER ACT (PUBLIC LAW 92-523)

a. Background

The Safe Drinking Water Act is the direct result of the first extensive survey of public water systems in the United States, which occurred in 1970. This survey, the 1970 Community Water Supply Survey, found that more than two million people were drinking "substandard" water and many others were receiving "potentially dangerous" drinking water. Other major findings of the survey indicated deficiencies in state inspections of water supply systems and in operator training in water supply or treatment facilities. As a result of this study, several states requested EPA to conduct extensive evaluations of their water supply programs. These studies identified the following deficiencies: 1) inadequate or outmoded treatment and distribution facilities; 2) inadequately trained operators; 3) insufficient operation and maintenance programs; 4) infrequent inspections by local or state agencies; and 5) low water rates which did not cover the costs of providing safe drinking water.

The documentation of the need to protect our nation's drinking water initiated the drafting of the Safe Drinking Water Act in 1974 and the National Interim Regulations of 1977. Through this Act, a cooperative program between local, state and federal agencies was initiated. The EPA was charged with the responsibility for administering the Act and the state and local agencies were to implement the Act.

b. General Provisions of the Safe Drinking Water Act

The Safe Drinking Water Act has five general provisions that serve to protect the public health and welfare. These provisions include: 1) the development of Primary Drinking Water Regulations for the protection of public health; 2) the development of Secondary Drinking Water Regulations that are related to taste, odor, and appearance of drinking water; 3) provisions for funding to states for technical assistance, personnel training and grants support to improve drinking water programs; 4) the development of regulations to protect underground drinking water sources; and 5) provisions for continuing research on problems related to drinking water supplies.

The most important provisions of the Safe Drinking Water Act are the development of the Primary and Secondary Drinking Water Regulations. The Primary Drinking Water Regulations (40 CFR Part 141) are federally enforceable and established limits on water contaminants that may adversely affect public health. The primary regulations defined operating characteristics for public water systems based on the type of consumer and water usage. In addition, the maximum contaminant levels and requirements for monitoring and analyzing these contaminants were established. The major categories of contaminants that require monitoring are: 1) inorganic contaminants such as arsenic, lead, and mercury; 2) organic contaminants such as pesticides and herbicides; 3) turbidity or suspended particles in water; 4) microbiological contaminants (bacteria, viruses, etc.); and 5) radiological contaminants from natural and man-made sources of radiation. Monitoring requirements vary somewhat depending on water supply source and the type of consumer and water usage in a public water system. Standard contaminant analyses, recordkeeping and reporting procedures are extremely important to ensure the public health and provide for successful implementation of the Act. Other primary regulations are concerned with the variances and exemptions to the Act, public awareness, and siting requirements for new facilities. The regulations became effective during 1977. They are interim regulations, however, and changes to them may be forthcoming.

The Secondary Drinking Water Regulations (40 CFR Part 143) are regulations that pertain to the aesthetic characteristics of drinking water such as taste, odor, and appearance. These regulations contain maximum contaminant levels for chloride, color, copper, corrosivity, foaming agents, hydrogen sulfide, iron, manganese, odor, pH, sulfates, total dissolved solids, and zinc. The regulations also consider other drinking water parameters including hardness, alkalinity, phenols, sodium concentrations, and standard plate count, a measure of bacterial concentration. These guidelines were published in 1977.

2. THE CLEAN WATER ACT (PUBLIC LAWS 92-500 AND 95-217)

a. Background

Federal efforts to clean up the nation's waters began with the passage by Congress of the Water Pollution Control Act of 1956. This Act, as well as subsequent legislation in 1961 and 1965, dealt primarily with enforcement procedures for water pollution abatement and with the establishment of water quality standards for all interstate waters. The current federal effort to clean up the nation's waters began with the passage of the Federal Water Pollution Control Act Amendments (Public Law 92-500) in 1972. Congress mandated that the nation's water could no longer be an integral part of waste treatment. Five years later, the law was modified by the 1977 Clean Water Act (Public Law 95-217). The two laws are collectively known as the Clean Water Act, and their express purpose is to eliminate discharge of pollutants into any surface water by 1985. The Clean Water Act was further amended by legislation passed in 1981.

b. General Provisions

The 1977 Water Pollution Control Act set as its major goal the protection of the aquatic environment. The primary strategy for reaching this goal was the establishment of effluent limitations to control pollution at either point sources (direct discharge from pipes) or non-point sources (diffuse discharges; e.g., runoff from agricultural or construction sites). The control of pollution sources as set down by the Act is not only more enforceable but also more equitable and uniform for similar polluters throughout the country. The legislation required state water quality agencies to establish standards based on the use of all surface waters in hopes of obtaining even more stringent controls on industrial and municipal dischargers. The legislation set deadlines for industrial and municipal point source discharges to meet the effluent limitation requirements. Communities with publicly owned sewage treatment works were directed to achieve the level of treatment necessary to meet water quality standards by July 1, 1988. The legislation is backed by significant financial and legal penalties, and is enforced by an EPA Regional Office or by the state water quality agency.

The Clean Water Act recognized the fact that communities would encounter financial difficulties as they attempted to meet the requirements and timetable established by the legislation. As an incentive, the Clean Water Act offers federal funding to cover 75 percent of the cost of constructing new publicly owned sewage treatment works or rehabilitating existing treatment facilities. In the past, community compliance with the Clean Water Act was indirectly tied to the availability of federal funds; however, recent revisions to the Act require communities to comply with the water quality standards regardless of whether or not federal funds are available.

c. Municipal Facilities Program

The two major sections of the present water quality laws that concern municipal wastewater are the National Pollution Discharge Elimination System (NPDES) permit program and the federal Construction Grants Program for Treatment Works. These two programs are commonly called the municipal facilities program. The NPDES program is primarily an enforcement tool for monitoring industrial and municipal discharges. The NPDES permits are issued and enforced by the EPA Regional Office or by a state water quality agency, and establish the effluent limit for point source discharge by an individual discharger.

The Construction Grants Program awards federal grants for facilities design (Step 2) and/or actual construction (Step 3). A portion of the facilities planning costs (Step 1) may be reimbursed through an allowance at the time the Step 3 grant is made. Strict conditions are imposed on grant awards by the EPA to ensure that projects are properly planned, environmentally safe, and cost-effective. To receive federal funding under the municipal facilities program, waste treatment must:

* Provide for evaluation of alternatives in order to apply the best practicable waste treatment technology before any discharge into receiving waters, including reclaiming or recycling water, confining pollutant disposal, and considering advanced waste treatment techniques;
* Be investigated on an areawide basis and provide for the control of all point and non-point sources of pollution;
* Encourage revenue-producing facilities that rely on recycling wastewater, confinement and containment of non-recyclable pollutants, and environmentally acceptable methods of sludge disposal;
* Analyze potential recreation and open space opportunities to integrate open space and recreational uses with waste treatment goals;
* Encourage energy-efficient design in facilities; and
* Evaluate innovative and alternative waste treatment management techniques.

The state water quality agency has an extremely important role in the construction grants program. The state is responsible for determining the recipients of federal funding as well as for certifying that all federal requirements are met prior to the actual grant award.

3. OTHER FEDERAL REGULATIONS

a. General

Federal regulations, in addition to the major acts discussed in the two previous sections, play an important role in the planning and design of water and wastewater facilities. In most cases, the requirements of other legislation and Executive Orders must be met during the planning stages, or the entire process may be vulnerable to a court challenge. Most of the regulations concern particular environmental resources and may require some supplementary study and coordination.

b. Summary of Legislation and Regulations Relating to Water Quality

Table 4 contains a brief summary of Executive Orders and other major federal regulations that require consideration during the planning phase and coordination during the design and construction phases of water and wastewater projects. The major regulations and the general provisions of each are summarized in this table.

TABLE 4

SUMMARY OF WATER QUALITY LEGISLATION & REGULATIONS

Legislation/Regulation	Reference	General Provisions
Endangered Species Act 16 U.S.C. 1531, Section 7	50 CFR 402 Public Law 91-135	Federal agencies shall ensure that their actions do not jeopardize listed species or modify critical habitat
Executive Order 11990 Protection of Wetlands	42 FR 26961 (1977)	Minimize the destruction, loss or degradation of wetlands; preserve and enhance natural values
Wild & Scenic Rivers Act 16 U.S.C. 1271-1287	Public Law 90-542	Preserve features that make designated rivers wild & scenic

TABLE 4
(cont.)

Legislation/Regulation	Reference	General Provisions
Executive Order 11988 Floodplain Management	42 FR 26591	Federal agencies shall avoid to the extent possible adverse impacts associated with floodplain modification and avoid support of floodplain development where there is a practicable alternative
River and Harbors Act of 1899	33 U.S.C., Subsection 10	Gives Army Corps of Engineers the authority to grant permits for construction, dredging, and filling in navigable waters
Executive Order 11296	31 FR 10663	Provide for agency evaluation of flood hazards in planning and construction of facilities
Executive Order 11593	36 FR 8921	Requires federal plans and programs to contribute to the preservation and enhancement of sites of historical, architectural and archaeological significance
National Historic Preservation Act of 1966	16 U.S.C., Subsection 470	Requires that prior to approval of federal activities, departments shall consider effect on National Register properties and give Advisory Council on Historic Preservation time to comment
Resource Conservation and Recovery Act of 1978 (RCRA)	Public Law 94-580	Suggests guidelines for proper disposal of solid and hazardous wastes and develops guidelines for resource recovery
National Environmental Policy Act of 1969 (NEPA)	Public Law 91-190	Requires preparation of an EIS for every major federal action that significantly affects the quality of the human environment

D. State Regulations and Guidelines

In addition to federal regulations and guidelines, the State of Montana has legislated requirements intended to preserve or enhance the quality of state waters. These regulations generally establish legal and administrative control over all phases of water and wastewater management including water quality regulations and standard design requirements for water and wastewater facilities. Federal legislation regarding water and wastewater facilities generally requires that individual states adopt standards at least as stringent as the federal guidelines. State laws, therefore, correspond quite closely with federal standards. Administration of federal programs at the local level is the responsibility of the state.

1. WATER QUALITY REGULATIONS

Primary regulations pertaining to the quality of state waters are outlined in the provisions of the Montana Water Quality Act. This legislation is intended to protect, maintain or improve the quality of all state waters and to provide a comprehensive program for the prevention, abatement, and control of water pollution. The Act established water quality standards based on present and future "most beneficial uses", and classified waters accordingly. The standards establish minimum in-stream water and waste treatment requirements to protect these beneficial uses from pollution. The Act also adopts a "non-degradation" policy which seeks to protect the water quality of Montana streams that have a higher water quality than the established water quality standards. This policy requires that any project or development constituting a new or increase source of pollution provide the degree of waste treatment necessary to maintain the existing high water quality. Other sections of the Act detail the administrative, financial and enforcement responsibilities of the State with regard to water quality management.

Under the provisions of the Montana Water Quality Act, two programs have been developed to protect the quality of the surface and groundwaters within the state. These programs include the Montana Pollutant Discharge Elimination System (MPDES) and the Montana Groundwater Pollution Control System (MGWPCS). The following narrative briefly discusses the general provisions of each program.

a. Montana Pollutant Discharge Elimination System (MPDES)

The Montana Pollutant Discharge Elimination System provides the state with a mechanism for authorizing and controlling point source discharges to surface waters. This program requires any person, agency, company or community discharging or planning to discharge wastewater to apply for a wastewater discharge permit from the Montana Department of Health and Environmental Sciences. The permit regulates the conditions of wastewater discharge, including the allowable quality and quantities necessary to maintain the quality of the surface water receiving the discharge. If the requirements of the discharge permit cannot be readily met by the discharger, target dates for compliance are established. The ultimate goal of the MPDES is to improve, reduce or eliminate wastewater discharge into surface waters in an economically feasible and orderly manner. Procedures and requirements of the program may be obtained from the Water Quality Bureau of the Montana Department of Health and Environmental Sciences.

b. Montana Groundwater Pollution Control System (MGWPCS)

The Montana Groundwater Pollution Control System was recently established by the Montana Department of Health and Environmental Sciences to control wastewater discharges into the state's groundwaters. Requirements of the program are similar to those of the MPDES in that all discharges of pollutants into state groundwaters must be authorized (after October 29, 1982) by permit and must be consistent with conditions outlined in the permit. Technical standards and procedural requirements of the MGWPCS are available from the State Water Quality Bureau.

2. PUBLIC WATER SUPPLY REGULATIONS

Regulations pertaining to public water supplies in Montana were adopted under authority of the Montana Public Water Supply Law. The Safe Drinking Water Act and National Interim Regulations were used as models for this law. The general provisions of this Law, such as the establishment of maximum contaminant levels and the establishment of standard monitoring, testing, recordkeeping and reporting procedures, were adopted by the Montana Legislature. In addition, Montana's regulations outline the requirements for variances or exemptions to the regulations and require a compliance schedule from the owners of public water supply systems that are granted such variances or exemptions. Other provisions of the regulations detail the general responsibilities and the enforcement powers of the Montana Department of Health and Environmental Sciences, Water Quality Bureau, in regard to administration of the Act.

3. STANDARD DESIGN REQUIREMENTS

The State of Montana, in an effort to assure protection of public health and the quality of state waters, has developed rules requiring the review of engineering plans and specifications prior to construction or modification of public water and wastewater facilities. The regulations have incorporated the Great Lakes - Upper Mississippi River Board of State

Sanitary Engineers, Recommended Standards for Water Works and Sewage Works, or "Ten State Standards", as state standards for design and review of plans and specifications. The two volumes serve as a guide in the design of water and wastewater facilities and aid in the preparation and review of plans and specifications for such projects. These standards are intended to provide the best engineered design standards for water and sewer systems as determined by research and practical experience. In addition, the standards suggest limiting values for the numerous elements incorporated into a design in an effort to aid in the evaluation of plans and specifications.

"Ten State Standards" have also been incorporated into Montana subdivision regulations to provide standards for the design of water and sewer systems. Such systems planned for subdivisions are subject to the same requirements for state review and approval as those for large municipal facilities. Other provisions of state subdivision regulations govern the operation and maintenance of water or sewer facilities within subdivisions to ensure that the quality of state waters are unaffected by development.

E. Operator Requirements

1. GENERAL

In an effort to maintain or improve the quality of state waters and to ensure the effectiveness with which water and wastewaters are handled, federal and state regulations have established a number of requirements for the operators of treatment and distribution facilities. These requirements generally include sampling, control testing, equipment performance monitoring, and recordkeeping and reporting procedures. The data accumulated from these procedures not only allows the performance of the water or wastewater facility to be evaluated by allows a history of data relating to user characteristics, water quality characteristics and costs to be accumulated. This data is extremely beneficial to designers of new facilities or improvements to existing facilities. The following narrative briefly summarizes the major requirements for operators of water and sewer systems within Montana.

2. WATER SYSTEM

In order to maintain the safety of public water supplies and to promote the efficient operation of public water supply systems, numerous requirements have been placed on operators of such systems. Federal and state regulations require sampling, control testing, laboratory analyses, and reports of plant operations to accomplish this goal. Five major categories of contaminants require monitoring, including inorganic chemicals, organic chemicals, turbidity, microbiological contaminants, and radiological contaminants. The monitoring requirements for these contaminants vary, depending on the source of the water supply and the type of public water system (community or non-community). A community system is one that has at least ten service connections used by year-round residents or which regularly serves at least 25 year-round residents. Other systems are classified as non-community systems, and generally involve intermittent usage. General monitoring requirements for public water systems in Montana are summarized in the following table.

TABLE 5

GENERAL MONITORING REQUIREMENTS FOR PUBLIC WATER SYSTEMS

		Sample Frequency	
Contaminant	Water Source	Community Systems	Non-Community Systems
Inorganic Chemicals	Surface	Yearly	Nitrate - every 5 years
	Groundwater	Every 3 years	
Organic Chemicals	Surface	Every 3 years	
	Groundwater	Not Required	
Turbidity	Surface	Daily	Daily
	Groundwater	Not Required	
Microbiological Contaminants	Surface Groundwater	Samples/Month based on population served by system (varies from 1 to 100)	Quarterly
Radiological Contaminants	Surface Groundwater	Every 4 years - quarterly in 4th year	

In addition to monitoring requirements for these major contaminant categories, other state regulations require daily control testing to ensure that water quality is maintained. Control testing of the various parameters of drinking water is dependent upon the water source and treatment methods, but generally consists of tests for alkalinity, chlorine residual, pH value, hardness, and turbidity. Standard sampling methods and accurate laboratory analysis of water samples is a key element in quality control for public water systems. Laboratory testing and analysis of samples should be conducted in accordance with accepted procedures outlined by the EPA or sent to state laboratories for analysis. Operators of public water systems will be assessed laboratory fees for testing done in state laboratories.

Recordkeeping and reporting procedures are also important operating requirements. Records and results of all sample analyses, control test samples, operating records of equipment and costs must be kept on file for a minimum of ten years. Operators are also required to submit monthly summaries of daily control testing to the Water Quality Bureau of MDHES. Accurate recordkeeping is valuable for future planning and for protection in the event of legal action regarding the performance of the system.

Montana law also requires certification of the operator of any water treatment plant or distribution system serving ten or more families or an industry employing ten or more persons. Water distribution systems and water treatment plants are classified by service area population, system complexity, and source of the water supply. Requirements for operator certification are dependent upon the classification of water treatment and distribution facilities. The Water and Wastewater Operators Board of MDHES will supply information regarding certification and testing procedures upon request.

3. SEWER SYSTEMS

Self-monitoring requirements for wastewater treatment plants and systems have also been delineated by state and federal regulations in accordance with the Clean Water Act. Sampling requirements for the monitoring of wastewater effluent parameters is intended to be representative of the volume and nature of the discharge. Effluent parameters which require monitoring include total flow, total BOD_5, total suspended solids, fecal coliforms, and pH units. The following table summarizes the effluent parameter and sampling requirements typical for smaller community systems.

TABLE 6

MONITORING REQUIREMENTS OF EFFLUENT PARAMETERS

Effluent Parameter	Sample Frequency	Sample Type
Total Flow	Weekly	Instantaneous
Total BOD_5	Quarterly	Grab
Total Suspended Solids	Quarterly	Grab
Fecal Coliforms	Quarterly	Grab
pH Units	Quarterly	Grab

Records of effluent sampling should specify the following information: a) exact place, date, and time of the sample; b) date of sample analysis; c) person(s) performing the analysis; d) analytical techniques or methods used; and e) results of the required analysis. A quarterly summary of discharge monitoring results must be submitted to the State Water Quality Bureau by the operator of the wastewater treatment system. The State may request additional wastewater monitoring subject to the accepted procedures for sampling, analysis and recording if conditions at the treatment plant merit further study. Records and information resulting from the sampling and analysis procedures, maintenance of instrumentation and recordings from continuous monitoring equipment must be retained for a minimum of three years, or longer if requested by the State.

Operators of wastewater treatment plants serving ten or more families or serving an industry employing ten or more persons must be certified by the State. Persons responsible for the daily supervision of the performance of the treatment plant should be available or on call at all times to ensure that the requirements for effluent quality are met. Wastewater systems are classified according to the size of the service area population and the complexity of the treatment system (primary or secondary treatment). Certification testing requirements for operators are dependent upon the classification of each wastewater treatment plant. Information regarding certification procedures and testing requirements may be obtained from the Water and Wastewater Operators Board of the MDHES.

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PUBLICATION SERIES

FINANCING COMMUNITY WATER AND SEWER SYSTEMS IN MONTANA

JULY 1983

Department of Commerce
STATE OF MONTANA
Community Development Division

FINANCING WATER AND SEWER SYSTEMS IN MONTANA

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I

Part I: Introduction

A. Background

For the past several years, the need for water and sewer improvements in Montana has increased dramatically. In many instances communities have relied on past investments in water and sewer facilities to serve present needs. The magnitude of this trend was recently brought to light by a survey conducted by the Montana League of Cities and Towns. This survey indicated that in excess of $85 million of capital improvements will be needed to extend, improve or rehabilitate existing water systems in Montana.

Although there is a real need for water and sewer improvements in the state's communities, many community officials find the process of planning, financing and implementing these improvements to be quite confusing and complex. The State of Montana Department of Commerce therefore identified the need to provide local communities with information and guidance on how to plan and develop an improvements program for water and sewer systems. With this need in mind, the Department of Commerce directed the preparation of two documents to be distributed to all communities and counties in the state. The first document prepared was entitled "Planning and Developing Community Water and Sewer Systems in Montana". The purpose of this document was twofold: first, it identified the various planning procedures necessary to effectively implement water and/or sewer improvements in a community, and secondly, it gave a brief overview of the components of water and sewer systems that are typically used in Montana. This document, the second document of the series, is intended to give local officials an overview of financial strategies that may be used to implement water and sewer improvements. It is felt that the combination of the two documents should give local officials a general understanding of the various procedures involved in the planning, implementation and financing of water and sewer improvements.

B. Purpose

The purpose of this workbook is to give local officials in the various communities and counties in the state an overview of the typical steps that must usually be taken to develop a financial strategy for implementing a water or sewer project. In addition, this document is intended to familiarize local officials with the various options available for financing typical water and sewer projects. These options include long-term financing, short-term financing, and local revenue sources.

In order to reduce the financial burden placed on taxpayers, many communities have obtained low-interest loans and/or grants in the past several years to finance water and sewer projects. These low-interest loans and grants have allowed many communities to make necessary improvements to their systems and still maintain affordable utility rates. Because the use of loans and grants has been an integral part of many communities' financing programs for utility projects, a brief overview of the various state and federal loan and grant programs available today is also given in this document.

Since the loan and grant programs as well as the legal procedures for obtaining revenues are dependent on and keyed to the state and federal legislative process, the information and requirements contained herein are in a constant state of change. Therefore, this information should be periodically updated to keep abreast of new legislative action. With this in mind, the information contained herein has been bound in a notebook form so that updated information can more easily be inserted to replace the original text. The Department of Commerce currently intends to prepare and distribute periodic updates of the information contained herein as legislative decisions and funding programs change. It should be noted, however, that the preparation of these updates is contingent upon available funding.

II

11

Part II: Financial Program Process

A. General

One of the most important steps that a community must take in order to complete a water or sewer system improvement is the development and implementation of a sound financial program. In many cases, the development of this program is overlooked in the initial planning stages. This oversight often results in project delays as well as possible additional costs.

The basic steps that should be followed for developing the financial program that is most appropriate and economical for implementing a water or sewer project are illustrated in Figure 1. The exact process will undoubtedly vary to some degree for each specific project, since the order in which various steps are conducted will depend on the community's situation and needs.

The following narrative gives an overview of the basic financing elements that are necessary for each of the steps depicted in Figure 1.

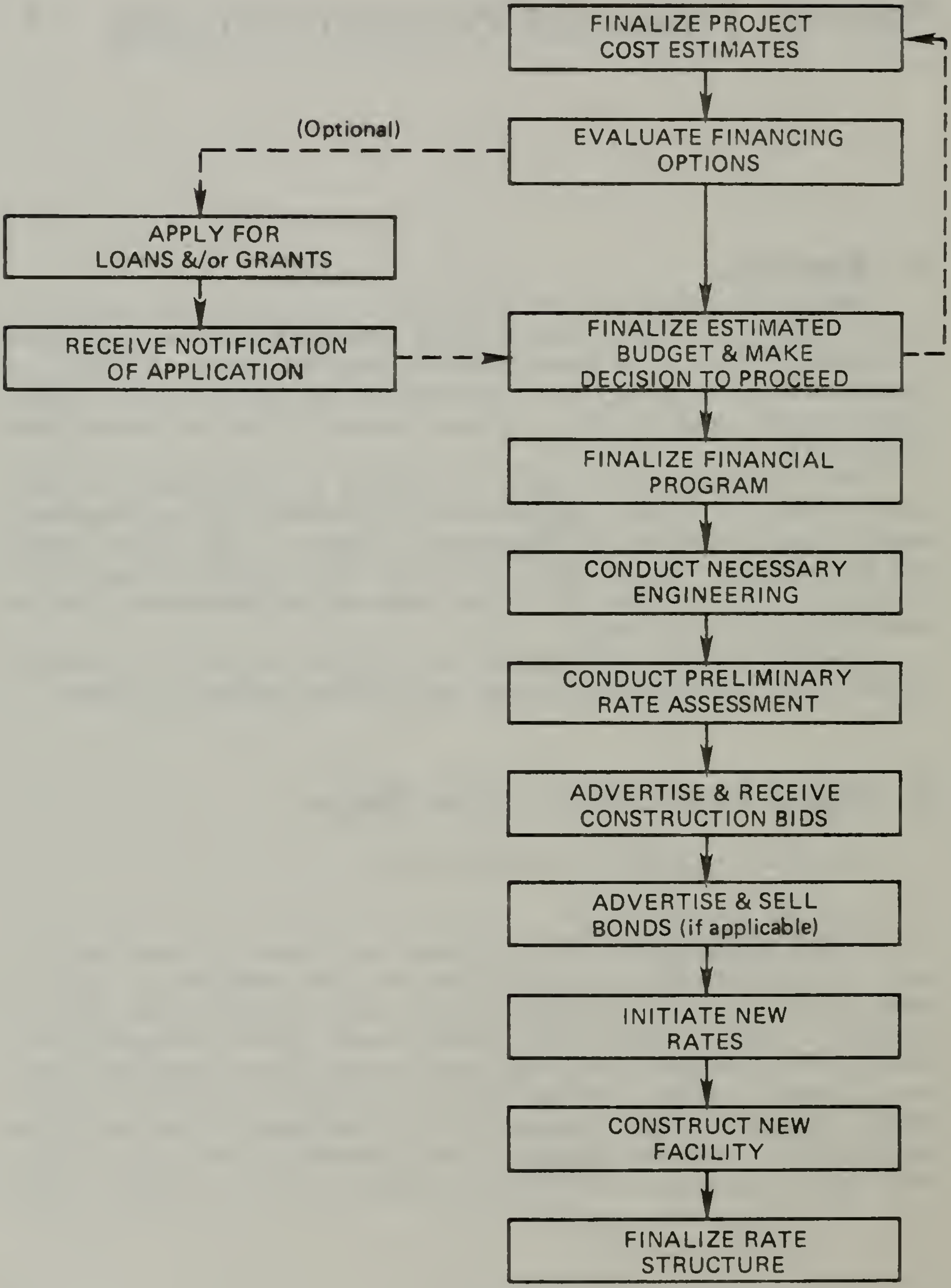
B. Major Financial Program Steps

1. FINALIZE PROJECT COST ESTIMATES

a. Evaluate Alternatives

A key element in the implementation of a water or sewer improvement is the evaluation of alternatives and the selection of the most cost-effective and practical option. The analysis of the costs for each alternative should include initial capital costs, interim financing costs, and annual operation and maintenance costs. Once these costs have been estimated, public meetings with local citizens and business leaders should be held to obtain comment. In many instances in the past, communities have made the mistake of not obtaining public input before choosing an alternative or deciding whether or not to proceed with a

Figure 1: Financial Program Process


FINALIZE PROJECT COST ESTIMATES
EVALUATE FINANCING OPTIONS
(Optional)
APPLY FOR LOANS &/or GRANTS
RECEIVE NOTIFICATION OF APPLICATION
FINALIZE ESTIMATED BUDGET & MAKE DECISION TO PROCEED
FINALIZE FINANCIAL PROGRAM
CONDUCT NECESSARY ENGINEERING
CONDUCT PRELIMINARY RATE ASSESSMENT
ADVERTISE & RECEIVE CONSTRUCTION BIDS
ADVERTISE & SELL BONDS (if applicable)
INITIATE NEW RATES
CONSTRUCT NEW FACILITY
FINALIZE RATE STRUCTURE

project. This public input phase can be very beneficial in the early stages, and should definitely not be overlooked.

b. Select Preferred Alternative

Once alternative costs have been identified and initial public input has been obtained, the governing body with the assistance of its staff and/or consulting engineer should select the preferred alternative. The capital and annual costs of this alternative should then be finalized. Finally, local officials should conduct a second public meeting to inform citizens of the selected alternative and the corresponding costs that can be anticipated.

2. EVALUATE FINANCING OPTIONS AND MAKE DECISION TO PROCEED

a. Capital Costs

Once the capital and annual costs of the project improvements have been estimated, the next key step is to evaluate the alternate options for financing the capital costs. Various options that are most often used for this purpose include: 1) utilizing a community reserve fund that has been accumulated with existing user fees or taxes; 2) selling bonds; 3) obtaining grants and/or loans from state and federal agencies; and 4) a combination of the three previous options. A detailed discussion of the procedures, advantages and disadvantages of these financing options are included in Parts III and IV of this workbook.

In many instances, communities apply to one or more state and/or federal agencies for loans and/or grants to offset the anticipated increased costs to local users of the proposed improvements. There are several loan and grant programs currently available to municipalities for improving, rehabilitating or replacing sewer and water systems. A discussion and overview of the primary programs are included in Part III.

Once a community has been notified whether or not they were successful in obtaining loans and/or grants, the final decision can be made on how the total capital cost should be financed. Many communities have used the following methods: 1) utilization of a combination of a loan and a grant from two agencies; 2) utilization of a loan or grant from an agency to finance part of the project and the proceeds from a bond sale for the remainder of the necessary funds; or 3) using the proceeds from a bond sale for the full amount of the project capital costs.

b. Local Revenue Options

Once the community has finalized the method by which capital costs are to be financed, the next step is to evaluate the most applicable options for obtaining the revenue necessary to pay for the capital expenditures that must be financed locally. Typical methods used by communities for this purpose are: 1) user charges based on water consumption or type and size of dwelling; 2) general taxes based on the mill levy; and 3) special improvement districts based on property size. A detailed discussion of these options and their respective advantages and disadvantages is given in Part IV. Once the decision on how to raise the local funds is made, individual assessments should be estimated.

c. Public Meetings and Decision

The final step involved for the community officials prior to making a decision on whether to proceed any further with the project is to hold an additional meeting to present costs and circumstances of the project to community citizens. The information presented to the public should include the specific need for the project and a description of the proposed improvements; the estimated costs to finance the capital expenditures, and the method by which the local funds will be obtained; and the estimated increase in annual user charges or taxes required to finance the capital costs and operation and maintenance cost of the proposed facilities.

Once the necessary public input has been obtained, local officials should decide whether or not to proceed with the project. If a decision is made not to proceed, local officials should re-evaluate the project's components and costs, and go through the process outlined herein again. If local officials obtain favorable comments from the public, the project should proceed to the final implementation phase.

3. FINALIZE FINANCIAL PROGRAM

a. Long- and Short-Term Financing

The initial step required to finalize the project's financial program is to decide on the method and schedule for obtaining funds for the capital investment (usually referred as the long-term financial requirements). Once this schedule has been finalized, the interim or short-term financing requirements should be identified. Short-term financing is used by local governments to meet financial commitments from the time the initial planning and engineering tasks have begun until the long-term funds have been procured on the local level.

The amount of short-term funds required varies appreciably from project to project, but usually depends on the long-term financing method that is used. In most instances, short-term financing will be required for the preliminary engineering work and the preparation of cost estimates. In addition, the community may require the assistance of legal and financial counsel, which would also be paid for by short-term financing. The most common sources of short-term financing for communities are: 1) reserve funds; 2) registered warrants; 3) short-term government notes; 4) revenue sharing funds; 5) local planning funds; and 6) Department of Natural Resources grants and loans (available for some projects). A more detailed analysis of these financing methods is included in Part IV.

b. Creation of Special Districts (if applicable)

Once the short- and long-term financing programs and cash flow requirements have been finalized, the next step is to create a special district if necessary. Special districts are typically formed if an improvement is being made to benefit a specific area of an incorporated community or to benefit a group of users in an unincorporated area.

The most common types of special districts include Special Improvement Districts (SIDs); Rural Improvement Districts (RIDs or RSIDs); and county water and sewer districts. The procedures for forming such districts and their uses are discussed in greater detail in Part IV.

When water and sewer improvements are planned to benefit an entire community and a revenue bond is to be used to finance the improvements, it is generally not necessary to create a special district. This is usually the case for most community water and sewer improvement projects.

4. CONDUCT FINAL ENGINEERING, AND PLANS AND SPECIFICATIONS

Once the financial program has been prepared and any necessary special districts have been created and approved, the community should retain a qualified professional engineer to prepare the final design, plans and specifications on the proposed improvements. It is very important for the community to make sure that all district formation procedures (if applicable) have been completed before instructing an engineer to proceed with this phase. In some instances in Montana, a community has had an engineer complete the design phase prior to forming the district. The formation of the district was subsequently rejected by the property owners. The community was then liable for a substantial engineering fee, and had no legal means of obtaining the necessary funds to pay the engineer. This potential hardship can be avoided if the district is created before the final design phase is begun.

Once the engineering design has been completed, the community must submit and obtain approval of the plans and specifications from the Montana Department of Health and Environmental Sciences, Water Quality Bureau. These plans and specifications must also be signed and approved by a professional engineer who is registered in Montana. Prior to submission, the community should conduct a thorough review of the plans and specifications to make sure that all improvements have been designed and located to satisfy the community's needs.

5. CONDUCT PRELIMINARY RATE ASSESSMENT

a. General

In order to finance the capital expenditures and annual operational costs of any water and sewer system, a user charge system and corresponding rate schedule must be developed and implemented. According to Montana Public Service Commission (PSC) requirements, all rates for water and sewer service must be established so that all users pay for their proportionate use of the system. All rate increases must be approved by the PSC unless one of the following two conditions prevails: 1) the rate is instituted to finance an improvement that is mandated by state and/or federal regulatory agencies to comply with federal drinking water or wastewater discharge standards; or 2) the rate increase represents less than a 12 percent increase over the previous rate. In addition to these PSC requirements, the sewer use ordinance and user charge system must be approved by the State Water Quality Bureau if the wastewater project is partially funded by an EPA Construction Grant. These studies are usually conducted by the consulting engineer retained to design and oversee the project.

b. Rate Study

In most cases, it is recommended that a rate study be conducted by local officials at the same time that the final engineering plans and specifications are being prepared. The rate study should evaluate the number of users, proposed budget including separate breakdowns for financing capital improvements, operation and maintenance costs for treatment facilities, operation and maintenance costs for either the sewage collection or water distribution system, whichever is applicable, and the administrative costs for the project. Based on these estimated annual expenses, alternate user charge systems and corresponding user rates should be evaluated. In most cases, user fees for water and sewer systems are assessed by one of the following methods: 1) a varied rate based on the volume of water used by each residential and commercial establishment; 2) a flat rate for each consumer; or 3) a combination of the two methods in which most of the users (typically the residential users) pay a flat rate and the larger users (typically commercial and industrial users) pay a varied rate depending on their use of the system.

c. Final Rate Structure

Once the various alternate user systems and corresponding rates have been calculated and revised by local officials, a meeting should be held to inform the public of the alternate rate systems that are being evaluated as well as the actual rate increases contemplated. After completion of the rate study and public comment period, local officials should select the rate system that is most acceptable and appropriate.

The final step involved in the rate assessment process is to obtain PSC approval of the recommended user system and rate schedule. This procedure varies depending on the situation, but usually requires notification of the proposed rate increase to each user, followed by a public hearing. It is recommended that all communities contemplating rate increases contact the PSC during the initial rate study process to determine the exact procedures appropriate for their specific situation. The Public Service Commission is located at 1227 Eleventh Avenue in Helena; their telephone number is 449-3008.

d. Implementation of Rates

Once the rate increase has been approved by the community and the PSC (and the Water Quality Bureau, if an EPA construction grant is being used to finance the project), the new rates should be put into effect when the construction of the improvements is begun.

6. SELLING OF BONDS

a. General

Four types of bonds are most often utilized by Montana communities to provide long-term financing of water and sewer improvements. These include: 1) general obligation bonds; 2) revenue bonds; 3) special assessment bonds; and 4) refunding bonds. The specific procedures for advertising and selling bonds for municipal water and sewer projects differ for each type of bond, and are summarized in Part IV of this workbook. As also discussed in Part IV, there are several consultants in the state who are experienced in bond marketing procedures, and it is recommended that all communities which do not have financial specialists on staff should seriously consider retaining a qualified bond counsel to assist in the bond sale process.

b. Bond Sale and Delivery

In most instances, funds derived from the sale of bonds will be delivered to the community within 30 to 45 days after bids have been received on the bonds. The community will then be able to use these funds as needed, while investing the remainder of the funds until required. The income from this investment is typically used to partially offset the initial capital investment required or to assist in financing the interim (short-term) costs of the project. Funds obtained from this investment are also frequently placed in the water or sewer budget and used to defray annual and operating costs of the system. The primary restriction on the use of these funds is that they must be utilized in the same budgetary category as the bond sale they derived from. (For example, if the improvement project being considered is for the water system, investment funds must be used for water-related expenses. They cannot be used for sewer- or street-related expenses.)

It is usually best to sell bonds at one of two points; immediately prior to the start of the final engineering phase, or immediately after construction bids have been opened. The primary advantage of selling bonds during the engineering phase is that funds can be obtained before major expenses are incurred. As a result, the short-term financing requirements are minimal. However, the primary disadvantage of this option is its lack of flexibility. In case the facility design changes in the final design phase or the construction bids exceed the preliminary cost estimates, a second set of bonds may have to be sold.

If bonds are sold after construction bids have been received, the amount of bonds sold will reflect the actual project costs quite closely. However, higher short-term financing costs will be incurred than if the bonds were sold prior to the start of the design phase. Since both methods of timing bond sales have been used with success over the past several years, it is recommended that each community discuss these options with the consultant engineer and financial specialist before a final decision is made.

7. FINALIZE RATE STRUCTURE

At the conclusion of the construction and start-up of the new facilities, it is recommended that the original budget estimated prepared during the design phase be re-evaluated and updated. Based on these updated costs, user charges should be adjusted to reflect the new budget. In many cases, final budget figures may vary considerably from those originally estimated. This is particularly true for projects involving large water and wastewater treatment facilities.

III

III

Part III: Loan and Grant Programs

A. Introduction

One of the primary sources of funding available to local governments wishing to undertake large capital projects such as water or sewer facilities has been federal and state financial assistance. These funds have traditionally been used to underwrite major portions of projects through the issuance of grants or loans which may be repaid at terms favorable to most communities. Most of these programs require a local matching share which is most often obtained by issuing municipal bonds. In many cases, the availability of funds will dictate the arrangement or timing of projects, since low-priority projects may be moved ahead of schedule to take advantage of available assistance. Experience has shown that delaying projects in hopes of obtaining federal or state assistance presents a large risk to a community since construction costs will most likely increase in the interim. Federal or state aid should not be anticipated in the preparation of project financing unless the availability of such funds is assured. Aid programs often require that funds be appropriated during sessions of Congress or the state legislature, and in many cases the appropriated funds are less than the amount requested by program management agencies. Some requirements attached to the aid programs (e.g. administrative procedures, minimum wage rates) may substantially increase project costs, making the assistance less attractive than it originally seemed.

In the past, significant amounts of federal and state aid were available for financing new capital facilities, including water and sewer projects. However, in recent years the amount and level of financial assistance for projects such as water and sewer facilities have been dramatically reduced. Currently, the primary federal programs available for water and/or sewer system improvements include HUD Community Development Block Grants, administered by the Montana Dept. of Commerce; Farmers' Home Administration Water and Waste Disposal Loans and Grants; and the Environmental Protection Agency's Construction Grants Program, administered by the Montana Dept. of Health and Environmental Sciences. State assistance programs for water or sewer systems include the Department of Natural Resources and Conservation's Water Development and Renewable Resources Development Programs, and the Montana Coal Board Grant and Loan Program.

The following narrative is intended to provide local government officials with a clear, concise summary of the federal and state assistance programs that may be utilized for improvements to community water or sewer systems. The purpose, type of funding, eligibility requirements, application procedures, and the ranking and approval process for each program will be emphasized. This chapter is organized into separate sections that identify programs applicable for water and/or sewer projects, and water or sewer projects only.

B. Water and/or Sewer Projects

1. COMMUNITY DEVELOPMENT BLOCK GRANT PROGRAM (CDBG)

a. General

The Community Development Block Grant (CDBG) Program is a competitive grant program designed to help communities of less than 50,000 population with their greatest community development needs, with particular emphasis on assisting persons of low and moderate incomes. The program was administered by the U.S. Department of Housing and Urban Development for seven years. Amendments to federal legislation in 1981 made state administration of the program an option. Governor Schwinden sought and received authorization from the November, 1981 Special Session of the Legislature to have the Montana Department of Commerce assume administration of the program beginning in 1982.

The goal of the Montana CDBG program is to develop viable communities by providing decent housing, healthy and safe living environments, and economic opportunities, principally for persons of low and moderate incomes.

For the purposes of the CDBG program, "low and moderate incomes" are defined as a person or household with a gross, unadjusted annual income below 80 percent of the median income for the county in which that person or household resides. All CDBG applications must document that a majority of those persons who will directly benefit from the proposed CDBG project are of low or moderate income households.

Eligible applicants may receive assistance in the form of single-purpose grants or comprehensive grants. Single-purpose grants may be awarded to applicants whose projects address a need in one of three designated project categories: economic development, housing, or public facilities. A project may consist of one or more activities designed to substantially meet a specific community need; however, the principal activity must represent at least 80 percent of the funds requested. The ceiling on single-purpose grants is $400,000 per applicant per year.

Sixty-five percent of the funds annually appropriated for the CDBG program are reserved for single-purpose grants.

Comprehensive grants may be awarded for projects that address a substantial portion of the identified community development needs within a defined, concentrated area or areas. The project must address community development needs in at least two of the three project categories. These grants may be awarded for up to three years, and the ceiling on these multi-year comprehensive grants is set at $500,000 per year. The remaining thirty-five percent of the annual appropriation for the CDBG program is reserved for this grant category.

The 1983 CDBG program will allocate $6,204,820 for both single-purpose and comprehensive grants. This funding level is expected to remain about the same for the next two years.

b. Eligibility Requirements

Eligible applicants for Montana's CDBG program are limited to counties and incorporated cities or towns. Each local government may submit only one application for its jurisdiction each year for projects falling within the three basic categories of economic development, housing, or public facilities. Billings and Great Falls, whose populations exceed 50,000, are classified as "entitlement communities" and receive CDBG funding on a formula basis directly under the administration of the U.S. Department of Housing and Urban Development. Montana's Indian Tribes also receive CDBG funds from a separate HUD CDBG program, and are not eligible for the state program. Special-purpose bodies such as local housing authorities, water or sewer districts, or local development corporations are not eligible to apply directly for CDBG funds, although they may be involved in implementing and administering a program if an eligible applicant agrees to such an arrangement.

Eligible activities are limited to those authorized by Congress in the Federal Housing and Community Development Act and must fall within the three designated project categories. Some examples of eligible activities for each of the categories include:

Economic Development

- Acquisition, construction, reconstruction, rehabilitation, or installation of public facilities and improvements of commercial or industrial buildings, structures, or equipment;
- Acquisition of real property for economic development purposes; or
- Activities to be carried out by a non-profit corporation, a local development corporation, or small business investment company to assist new or existing small businesses through grants, loans, guarantees, interest supplements, or technical assistance. Assistance may also be provided to private, for-profit entities when the assistance is necessary or appropriate to carry out an economic development project.

Housing

- Rehabilitation of private properties and rehabilitation financing;
- Clearance, demolition, and removal of buildings and improvements;
- Building code enforcement in deteriorated areas;
- Rehabilitation of public residential structures, including permanent housing units, residential facilities such as group homes, and modernization of public low-income housing;
- Relocation payments and assistance;
- Acquisition of real property for residential development that is deteriorated or undeveloped or appropriate for rehabilitation, preservation, or restoration; and
- Disposition of real property.

Public Facilities

- Acquisition, construction, reconstruction, rehabilitation, or installation of publicly owned facilities and improvements including:
    - Water and sewer facilities;
    - Solid waste disposal facilities;
    - Fire protection facilities and equipment;
    - Flood and drainage facilities;
    - Street improvements;
    - Parking facilities, pedestrian malls, walkways;
    - Senior centers, centers for the handicapped;
    - Parks, playgrounds, and recreational facilities; and
    - Neighborhood facilities
- The payment of the non-federal share in connection with another federal grant program undertaken as part of a CDBG project;
- The payment of special assessments levied against properties owned and/or occupied by low- and moderate-income persons for the capital costs of eligible public facilities and improvements financed from local revenue sources; (Note: Congress is currently considering legislation which may severely restrict the use of the CDBG Program for this purpose beginning with FY 1984 funds); and
- Projects related to the removal of material and architectural barriers which restrict the mobility and accessibility of elderly and handicapped persons.

A complete listing of eligible activities is contained in the 1983 Montana Community Development Block Grant Program guidelines available from the Montana Department of Commerce. This publication details the many eligible activities for the three project categories, and identifies the number and percentage of low- to moderate-income households for each eligible county and incorporated city or town.

c. Application Procedures

All eligible applicants are required to comply with general "threshold" requirements in order to compete for grant funds as well as other threshold requirements for public facilities projects. The general and specific threshold requirements that are particularly important to public facilities projects include:

- Submission of documents indicating that the overall community development needs have been assessed. This needs assessment is a detailed process that attempts to ensure that a community has evaluated all development needs and has logically identified its capital improvement priorities through efforts which include public involvement.
- Submission of a description not to exceed five pages of the community's overall plan for meeting its public facility needs;
- Statement whether the principal purpose of the CDBG project being applied for is to:
    - benefit low- to moderate-income households;
    - aid in the prevention or elimination of blighting conditions; or
    - respond to community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community, where other financial resources are not available to meet such needs.

  Regardless of which purpose is selected, each applicant must document that a majority of those persons who will directly benefit from the proposed project have low to moderate incomes.
- Provision of preliminary engineering or construction information sufficiently detailed to describe the scope of the problem and the estimated costs; and
- Documentation that other federal, state or local resources are not available to meet the need.
- Submission of assurances that the applicant will comply with all applicable federal and state laws and restrictions, if awarded a grant.

If a public facilities project is proposed along with economic development and/or housing activities and submitted as a comprehensive application, the requirements differ somewhat from those discussed for single-purpose applications. Instead of a five-page description of the overall plan for meeting public facilities needs, a community development plan must be prepared. It must include a summary of community development needs; a comprehensive strategy that considers public facilities, housing, and economic development; a comprehensive project summary; and maps. All other requirements stated above apply.

Applications for the 1983 CDBG Program are due July 1, 1983. The Department intends to announce grant awards by October 1, 1983. Following the announcement of awards, it will probably take at least two months before any funds will actually be received by the local governments selected. During the interim period, the following requirements must be fulfilled: 1) a contract between the grantee and the Department must be prepared, 2) the grantee must conduct a review of environmental factors, and 3) all the details for assuring proper management of the project and the federal funds must be finalized. In addition, the Department will conduct training sessions to familiarize grantees with the numerous federal and state laws and regulations which must be complied with. These requirements include areas such as environmental impacts, civil rights, fair housing, labor practices, and administrative and financial management.

Applications for the 1984 CDBG program will tentatively be due in February, 1984. Prior to that time, application workshops will be held to familiarize local officials with requirements of the 1984 program.

d. Ranking and Approval

The demand for CDBG funds has always far exceeded the amount of money available; only about one out of four applications has received funding. Because the program is so competitive, a ranking system has been developed to provide an objective means to evaluate the degree to which a proposed project responds to the criteria for its type of project. A review committee of Department of Commerce staff evaluates and ranks the applications and makes recommendations to the Director of the Department, who makes the final decision on grant awards.

Because of the importance of the ranking criteria, communities should be cautious in selecting activities for a CDBG application. The fact that an activity may be legally eligible under the federal statute does not insure that it will be appropriate or competitive under the guidelines and ranking system. For example, local comprehensive planning activities are eligible under the federal statutes; however, a local planning project would not be very feasible or competitive under the state CDBG requirements or ranking criteria.

All single-purpose applications are ranked according to four common criteria which include need, appropriateness, impact, and benefit to low- and moderate-income persons. Under the ranking system for single-purpose projects, each of the three project categories has its own subsystem, which is used to rank projects applying under that category. Each subsystem uses different definitions of the four criteria to provide measures appropriate for each project category. The four criteria by which 1983 single-purpose public facility CDBG applications (including water or sewer projects) will be ranked are as follows:

Need (200 points)

- * Severity and immediacy of the threat to the public health or safety, or severity of blighting conditions affecting the project area (150 points)
- * Financial need for CDBG assistance (50 points)

Appropriateness (200 points)

- * Rationale for selection of the project (50 points)
- * Project plan: facility design, financing mechanism, and maintenance and operation (50 points)
- * Community involvement and efforts to resolve the problem locally (50 points)
- * Efforts to secure alternative or additional funds (50 points)

Impact (200 points)

- * Complete and long-term solution (100 points)
- * Financial impact on assisted households, particularly low- and moderate-income (100 points)

Benefit to Low- and Moderate-Income Households (200 points)

- * Number of LMI households benefitting divided by the total number of households benefitting yields the percent benefit to LMI households

The ranking system for comprehensive applications differs from the above-described system for single-purpose applications, and includes the following factors:

Project Factor (400 points)

- * Appropriateness and soundness of entire proposed project as it relates to needs, goals, objectives, and priorities set forth in the comprehensive community development plan

Activity Factor (800 points)

- * Strength and impact of the proposed project activities. Public facilities, housing, and economic development project components will be evaluated according to the single-purpose ranking criteria for each of those areas. Points will be awarded in proportion to the percentage of CDBG project funds for each of the three areas.

Upon submission of the application, Department of Commerce staff will review the application for completeness and for conformance to program requirements. Following this initial review, each CDBG application will be evaluated by a CDBG staff person and a member of the Department of Commerce's Ranking Committee. This team is responsible for preparing a project summary that includes a description of the proposed project's response to the ranking criteria and any concerns raised during the review process. The project summary is then presented to the Ranking Committee, which must assign scores for each ranking criteria after considering the proposed project's response to the four items. Total possible maximum scores for applications are 800 points for single-purpose grants and 1,200 points for comprehensive grants. The order of scores for all applicants determines the rank of each applicant. The actual number and types of awards will be subject to funding availability, the amount of each applicant's request, and departmental guidelines regarding fund distribution.

If awarded a grant, the recipient must complete final arrangements within six months from the date the awards are announced to assure availability of all other funding sources for the project. This includes private funds, local sources such as bonds and improvement districts, state funds such as the DNRC Water Development Program or Coal Board money, and federal sources such as FmHA or the EPA's Wastewater Treatment Construction Grants Program. Figure 2 generally depicts the procedural requirements of the CDBG Program.

e. Program Contacts

Copies of the 1983 program guidelines and other information about the CDBG program can be obtained by contacting:

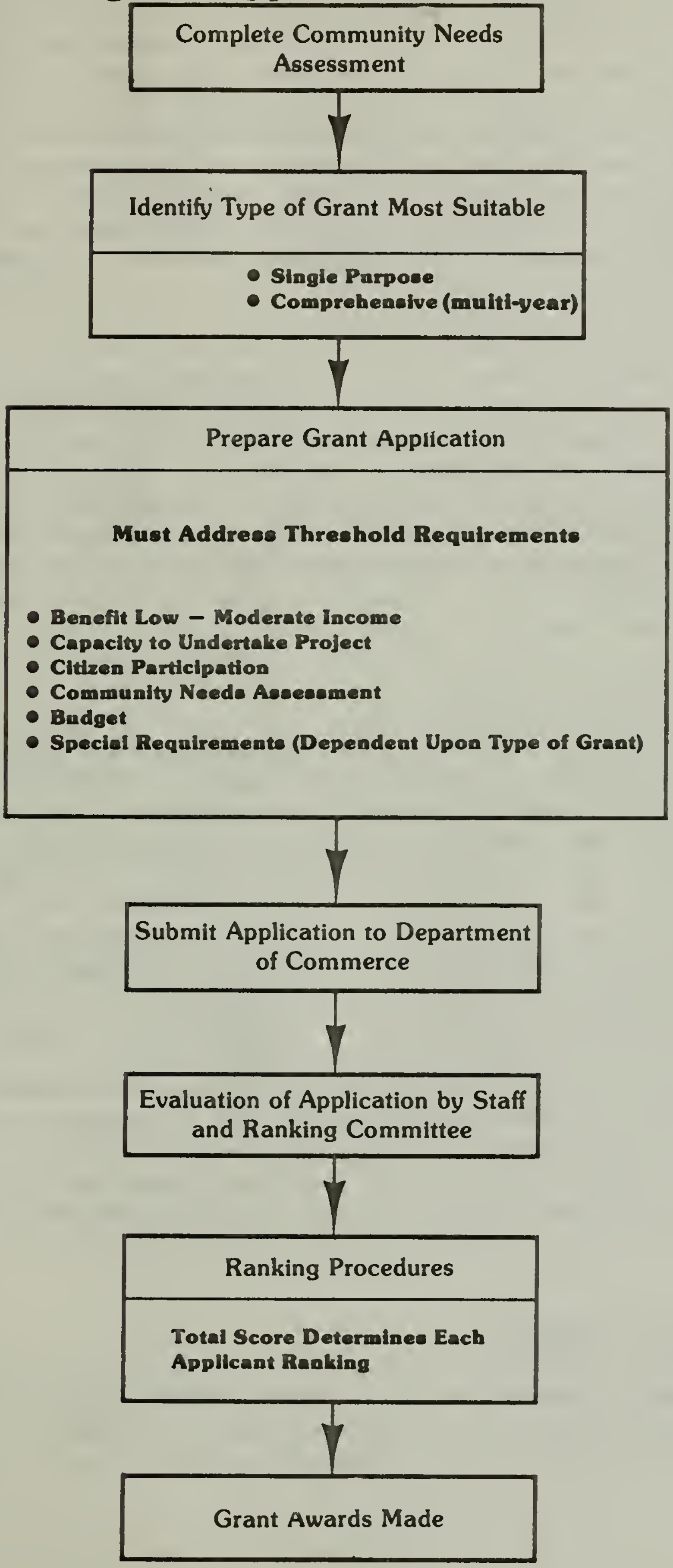
Dave Cole or Bobbi Balaz-Davis
Montana Department of Commerce
Economic & Community Development Division
1424 Ninth Avenue (Capitol Station)
Helena, Montana 59620
Telephone: (406) 449-3757

2. FmHA WATER & WASTE DISPOSAL LOANS & GRANTS

a. General

The Farmers Home Administration (FmHA) has established the Water and Waste Disposal Loan and Grant program to provide financial assistance to communities of 10,000 population or less for needed water and/or sewer facilities. These funds may be used for the installation, repair, improvement or expansion of water or sewer facilities where other means of financing are not available. Eligible applicants may receive assistance in the form of grants or loans. Grant funds may be available to underwrite up to 75 percent of eligible facility costs; however, grants may not be used to pay interest on loans, operation and maintenance costs, or to acquire or refinance existing systems. Grants are made only when necessary to reduce the average yearly charges to users of the proposed facilities to a level determined to be reasonable

Figure 2: Community Development Block Grant Program Application Procedures


Complete Community Needs Assessment
Identify Type of Grant Most Suitable
• Single Purpose
• Comprehensive (multi-year)
Prepare Grant Application
Must Address Threshold Requirements
• Benefit Low — Moderate Income
• Capacity to Undertake Project
• Citizen Participation
• Community Needs Assessment
• Budget
• Special Requirements (Dependent Upon Type of Grant)
Submit Application to Department of Commerce
Evaluation of Application by Staff and Ranking Committee
Ranking Procedures
Total Score Determines Each Applicant Ranking
Grant Awards Made

by the FmHA. Loans with interest rates based on current market yields for municipal obligations are also available to communities. Loans may be made at lower rates if certain population and median income requirements are met. Statutes have not established maximum loan amounts, but repayment must occur within 40 years from the date of issuance.

Interim financing from commercial sources is normally used during construction for FmHA loans, and costs to communities are reimbursed by FmHA at the completion of the project. If interim financing is not available or if the cost of such financing is less than $50,000, multiple advances may be made to the community based on the progress of construction activities. Funding for this program is on-going, and awards are made as the FmHA requirements are met. Portions of the state allocation not obligated reverts back to the national FmHA office (50% by April 5 and 100% by August 2). If projects arise between these dates, competitive requests for funds can be made to the national office for expenditure prior to the beginning of the new federal fiscal year (October 1). FmHA funds are not carried over from year to year; however, applications for funding are carried over. Funds are allocated to states based upon rural populations and the number of households with incomes below the poverty level. This program requires no matching funds from applicants.

b. Eligibility Requirements

Eligible applicants include public entities such as counties, municipalities, special purpose districts or authorities, cooperatives, associations, non-profit corporations, and federally-recognized Indian tribes for rural areas and communities of up to 10,000 residents. Applicants must be unable to finance the proposed project from their own resources or from any other source of commercial credit, must be able to legally finance, operate and maintain the proposed facility, and must be financially sound to ensure that the facility is properly managed and the debt repaid.

Projects eligible for grant or loan assistance through this FmHA program include those that construct, repair, improve or expand rural water or wastewater facilities, including individual components of such systems. Program funding assistance may also be used to acquire water supplies or water rights, or pay legal and consulting fees or other costs related to the development of facilities. Grants and loans may also be used as a source of joint funding with other suitable public programs identified by the FmHA.

c. Application Procedures

Applicants eligible for financial assistance in the form of grants or loans are initially required to file a preapplication with the local or district FmHA office from which assistance may be obtained. The district offices, which are located in Billings, Great Falls, Missoula and Glasgow, can provide technical assistance in the preparation of the pre-application forms. Once a pre-application is approved by the District Director, a meeting with the applicant, the applicant's engineer and the applicant's attorney is conducted to assign the tasks required for a full application. After the pre-application and full application forms (including an environmental assessment) have been reviewed by the District Director, the application package is forwarded to the State FmHA office in Bozeman for review, processing, and funding approval. Once a pre-application is approved, nearly all technical assistance rests with the State office.

d. Ranking and Approval Process

At the present time, there is no ranking procedure for project applicants. Since available funding has traditionally exceeded the amounts requested, the general award policy has been based on "first come, first served". Program rules state that priority will be given to governmental entities with less than 5,500 residents; to projects that will enlarge, extend or modify an existing facility to provide more efficient and economic service to rural residents; and to projects serving low-income communities. Ranking procedures are currently being formulated and should soon be published in the Federal Register.

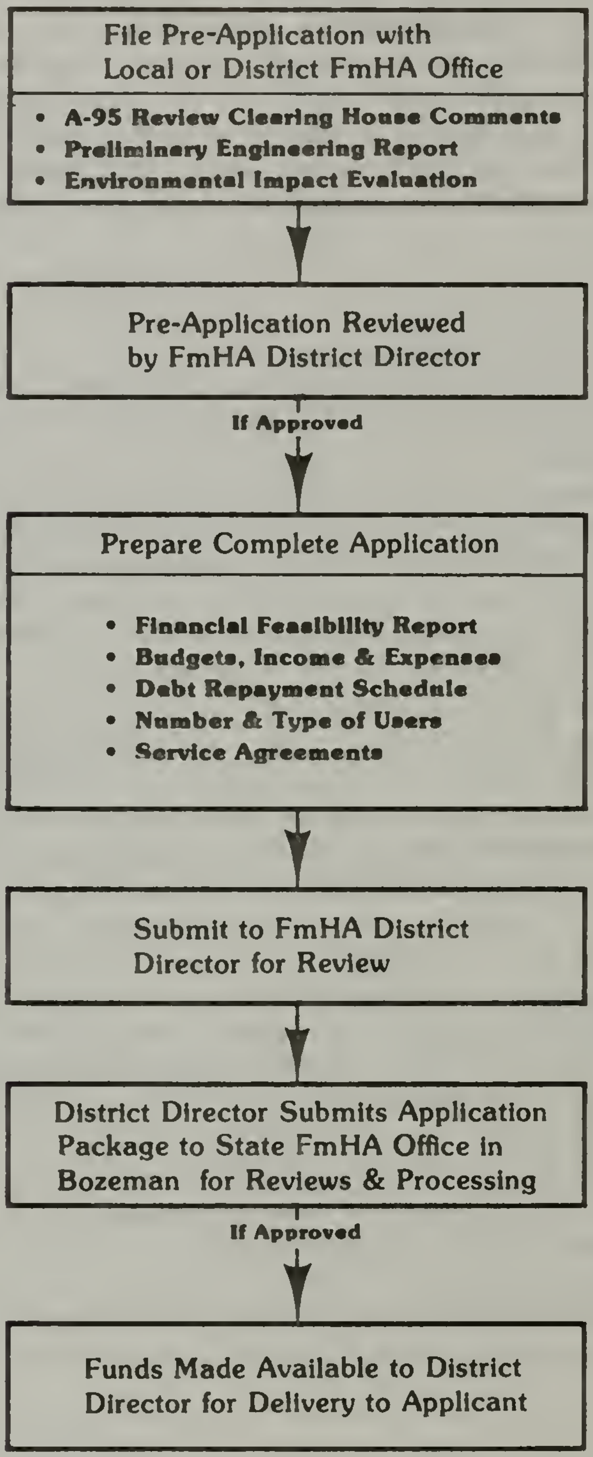
After loan or grant approval and application processing are completed at the State FmHA office, funds are made available to the FmHA District Director for delivery to the applicant. It usually takes between 30 and 90 days for applications to be approved or disapproved. Typical procedures associated with the FmHA Water and Waste Disposal Loan and Grant Program are depicted in Figure 3.

e. Program Contacts

Preapplication and application forms, in addition to other information about the FmHA Water and Waste Disposal Loan and Grant Program, may be obtained by contacting:

Ted Hebnes or John Olerud
Community Facility Loan Program
Farmers Home Administration
P.O. Box 850
Bozeman, Montana 59715
Telephone: (406) 587-5271

Figure 3: FmHA Water and Waste Disposal Loan & Grant Program Application Procedures


File Pre-Application with Local or District FmHA Office
• A-95 Review Clearing House Comments
• Preliminary Engineering Report
• Environmental Impact Evaluation
Pre-Application Reviewed by FmHA District Director
If Approved
Prepare Complete Application
• Financial Feasibility Report
• Budgets, Income & Expenses
• Debt Repayment Schedule
• Number & Type of Users
• Service Agreements
Submit to FmHA District Director for Review
District Director Submits Application Package to State FmHA Office in Bozeman for Reviews & Processing
If Approved
Funds Made Available to District Director for Delivery to Applicant

3. MONTANA COAL BOARD GRANT AND LOAN PROGRAM

a. General

The Montana Coal Board provides financial assistance in the form of grants or loans to enable local jurisdictions to adequately provide for the expansion of governmental services and/or facilities that are needed as a direct result of coal development activities. It is the intention of the Coal Board to assist local efforts in planning for and meeting the needs for public services such as water or sewer facilities. Grants are available to fund up to 80 percent of the costs of main water and/or sewer lines, storage and treatment facilities, and other system components that the Coal Board determines to be essential to the function of such systems. Grant funds may be committed for more than one year for a single project, provided funding does not extend for more than ten years and does not exceed reasonable revenue expectations. No state agency or governing body of a federally-recognized Indian tribe may receive grants exceeding seven percent of the annual allocation to the Coal Board. Recent legislation authorized loans to be awarded to eligible applicants from the same source as the grants (8.75% of the coal severance tax). These loans must be repaid within 20 years at an interest rate yet to be determined by the Coal Board. Loans must be used or committed for use within one year of the approval of the loan. No loan will be approved by the Coal Board if money used to repay the loan is to be derived from property taxes. Available funding for Coal Board grants and loans is projected to be $8,632,225 and $10,768,363 for FY 1984 and FY 1985, respectively.

b. Eligibility Requirements

Applicants eligible to receive financial assistance under the guidelines of this program include local governmental units, state agencies, governing bodies of federally-recognized Indian tribes, improvement districts, and water and sewer districts. Each of these governmental units must represent an area that is experiencing impacts from coal development. Coal Board financial assistance may be used for the construction, reconstruction, expansion and maintenance of a water and/or sewer system that serves any new or existing residential area directly impacted by coal development. Counties and municipalities may utilize grants to pay for the expenses of rural or special improvement districts. Use of loans is somewhat limited by the fact that property taxes may not be utilized for repayment; loans must be retired from user fees.

c. Application Procedures

Prospective applicants are required to submit 15 copies of a preapplication package to the Coal Board Administrative Staff 30 days before any of the six to eight scheduled Coal Board meetings held throughout the year. The pre-application must include a complete description of the proposed project, a preliminary engineering report with estimated project costs, the estimated project completion date, documentation of the project's relationship to coal development, and documentation of the applicant's legal and financial ability to undertake and manage the proposed service or facility. Once the pre-application proposal is received, it is reviewed by a committee of Department of Commerce staff and other appropriate agencies and consultants. The comments received during the review process are used by the Administration Officer of the Coal Board to formulate a recommendation to approve or deny the pre-application proposal. The reviewed pre-application and the Administrative Officer's recommendation are then presented to the Coal Board at the next Board meeting. The applicant may formally present the pre-application to the Board at this time. After a review of all pre-application information, the Board may take official action and the proposal may be approved, denied, or tabled. If the pre-application is approved, the applicant is required to submit 15 copies of the final full application forms 30 days before the next scheduled meeting. The Board may require additional information to be submitted with the full application, including local government budgets, documentation of local efforts to resolve coal development impacts, documentation of local planning efforts and citizen participation, and firm bids or estimates of project costs. Applicants are required to present the final proposal to the Coal Board at their next scheduled meeting. Technical and procedural assistance regarding application requirements is available from Coal Board administrative staff and Department of Commerce personnel.

d. Ranking and Approval Process

The Coal Board has no formal ranking procedure for grant or loan applications; however, funding is awarded on the basis of four guidelines which include:

Need

* What assistance is required to eliminate or reduce the severity of the problem affecting the health, safety, or welfare of the public

Severity of Impact

* What has been the rapidity of growth and the subsequent expansion of the problem, and to what extent have community residents been affected

Availability of Funds

* Can the request for funds be granted from available funds

Degree of Local Effort

* What are the historical and present borrowing and taxing efforts in the community, and what efforts have been made to secure funds from other sources

After the Coal Board has evaluated the final application proposal and its relationship to the four award guidelines, the Board may take action on the final application and designate the amount of assistance and contract stipulations.

The Coal Board will award 50 percent of its annual appropriation to local governmental units that have experienced or expect to show evidence of a 10 percent increase in population as a direct result of coal development activities during five designated three-year periods. For fiscal year 1983, the designated periods are those from 1978 to 1981; 1979 to 1982; 1980 to 1983; 1981 to 1984; and 1982 to 1985. The designated three-year periods will advance one year ahead with each passing year. Communities that experienced such population growth are "designated" by the Department of Commerce, and are reviewed annually. Other communities that are planning for or have experienced impacts as a direct result of coal development, but which may not have experienced the ten percent growth within any of the designated three-year periods, are referred to as "non-designated" communities. These non-designated communities may apply for the remaining 50 percent of the annual appropriations. Grant or loan awards to these communities are dependent on the four award criteria. Procedures regarding the Montana Coal Board Grant and Loan Program are summarized in Figure 4.

e. Program Contacts

Information regarding the Montana Coal Board Grant and Loan Program may be obtained by contacting:

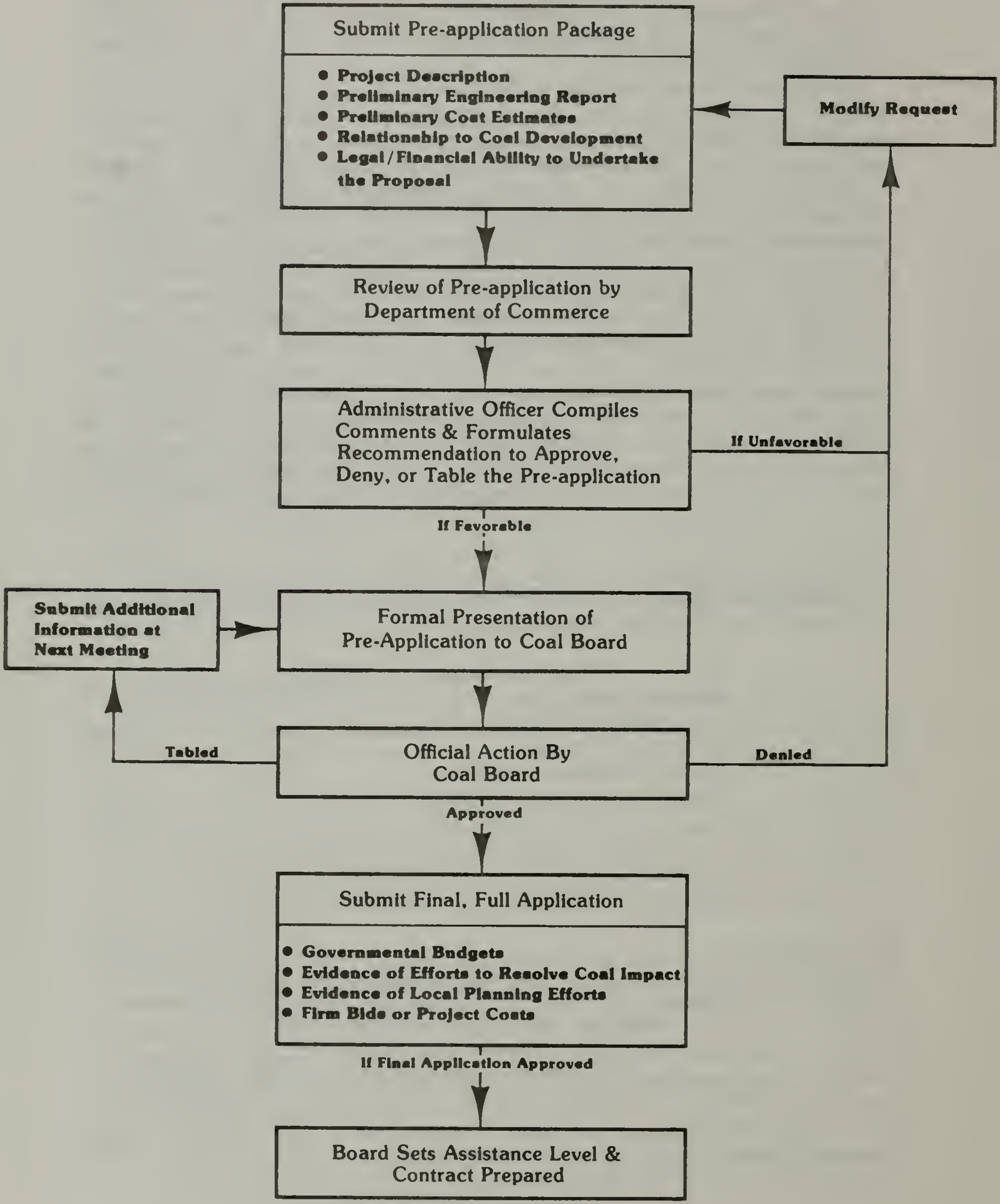
Murdo Campbell, Administrative Officer
Montana Coal Board
Department of Commerce
1424 Ninth Avenue
Helena, Montana 59620-0401
Telephone: (406) 449-2400

4. DNRC RENEWABLE RESOURCE DEVELOPMENT PROGRAM

a. General

The Renewable Resources Development Program (RRD) is administered by the Montana Department of Natural Resources and Conservation (DNRC) in order to conserve Montana's renewable resources by using a portion of the coal severance tax for their protection and development. State law requires that DNRC attempt to attain three goals through the use of RRD funds. These goals are "to enhance public resources; optimize public benefits; and to promote conservation and efficient use of renewable resources".

Figure 4: Montana Coal Board Loan & Grant Program Application Process


Submit Pre-application Package
Project Description
Preliminary Engineering Report
Preliminary Cost Estimates
Relationship to Coal Development
Legal/Financial Ability to Undertake the Proposal
Modify Request
Review of Pre-application by Department of Commerce
Administrative Officer Compiles Comments & Formulates Recommendation to Approve, Deny, or Table the Pre-application
If Unfavorable
If Favorable
Submit Additional Information at Next Meeting
Formal Presentation of Pre-Application to Coal Board
Tabled
Official Action By Coal Board
Denied
Approved
Submit Final, Full Application
Governmental Budgets
Evidence of Efforts to Resolve Coal Impact
Evidence of Local Planning Efforts
Firm Bids or Project Costs
If Final Application Approved
Board Sets Assistance Level & Contract Prepared

At one time, the RRD program was allocated 1.25 percent of the coal severance tax revenues not set aside for the constitutional trust fund. However, the 1981 Legislature amended the law to allocate one-half of this amount (.625%) to the RRD program and the Water Development Loan and Grant Program. The 1981 legislation also required that the RRD fund be divided so that 15 percent is used for timber stand management, 40 percent for water development, 15 percent for agricultural land improvements, 10 percent for conservation districts for development of water reservations, and 20 percent for projects that DNRC considers appropriate.

Financial assistance is available to applicants in the form of grants or loans. Grants are available only to divisions of state government. There are two bonding authorities that can be used by the State to provide funds for RRD loans. One of the primary sources is a $250 million revenue bonding authority backed by the coal severance tax trust fund that can be used to fund any water-related project. These loans are available to all state and local governmental entities, and must be repaid in 30 years or in the life of the project, whichever is less. There is no limit on the amount of these loans, and interest rates are based on the municipal bond market sales. The other major source of funding for RRD loans is from a $5 million general obligation bonding authority. This source can provide state and local governmental entities and private individuals with funding for any type of water-related project. There is a $200,000 limit on loans from this source. Loan recipients must repay the loan at interest rates determined through the bond sale over a term of 30 years or the life of the project, whichever is less. The levels of funding for Renewable Resource Development programs are projected to be approximately $620,000 for FY 1984 and $770,000 for FY 1985.

b. Eligibility Requirements

Eligible applicants include any division of local or state government including counties, municipalities, commissions, boards, agencies, or departments. Private individuals are also eligible for loans from funds made available from the state general obligation bonding authority. The RRD program may provide funds for the construction, purchase or lease of projects for the conservation, management or development of Montana's renewable resources such as fish and wildlife, recreation and water. In regard to water or sewer projects, funds may specifically be used for the design or feasibility studies for such projects, for developing plans for rehabilitating, modifying or expanding existing facilities, or for purposes that the Legislature may approve. Grants may be awarded for amounts equal to the total cost of feasibility studies or proposed project activities for jurisdictions with no repayment capacity.

c. Application Procedures

Eligible applicants are required to undertake a two-step application procedure. Applicants are initially required to submit a brief statement of intent to the DNRC Water Development Bureau, which determines whether or not the project or activity is eligible for program funding. If the project is eligible for funding, a complete application must be prepared and submitted by the applicant. This application must document the need for the project and identify alternative solutions. The alternative chosen must be the least expensive feasible alternative.

Technical, economic, environmental and financial information must also be submitted with the application. Typically, two bids or an engineer's design and cost estimate, as well as other supplementary information, are required to demonstrate technical feasibility. A description of the project's costs and benefits must be included to demonstrate economic feasibility. An environmental review form, provided by DNRC, must be submitted to determine the project's environmental impacts. Necessary financial information must also be submitted on financial statements, profit-loss and cash flow forms available from DNRC. Applicants may obtain forms and assistance in the preparation of applications from Water Development Bureau staff or other DNRC personnel.

All information regarding the technical, economic, environmental and financial feasibility of a project must be presented for review by DNRC staff and other qualified experts. Once the review is complete, the feasibility of the project is determined. If the proposal is determined to be feasible, it is then ranked for funding recommendations. Applications must be submitted by June of the year preceding the regular Legislative session.

d. Ranking and Approval Process

A point scoring system is utilized by DNRC to rank all proposals according to their relationship to seven designated program goals. These goals include:

Enhancement of Public Resources

* Consideration is given to the project's effect on Montana's renewable resources

Optimization of Public Benefits

* The public benefit of the project is determined (including health, safety, conservation, natural environment, and economic benefits)

Conservation and Efficient Use

* The project's effects on the use and conservation of renewable resources is evaluated

Need and Urgency

- Consideration is given to immediate and future problems and how the project will alleviate them

Environmental Feasibility

- Projects with the least environmental impact will receive preference

Potential for Statewide Application

- Consideration is given to projects that will provide new information or technology that may be used statewide

Prior RRD Funding

- More consideration is given to projects that have not utilized RRD funding in the past

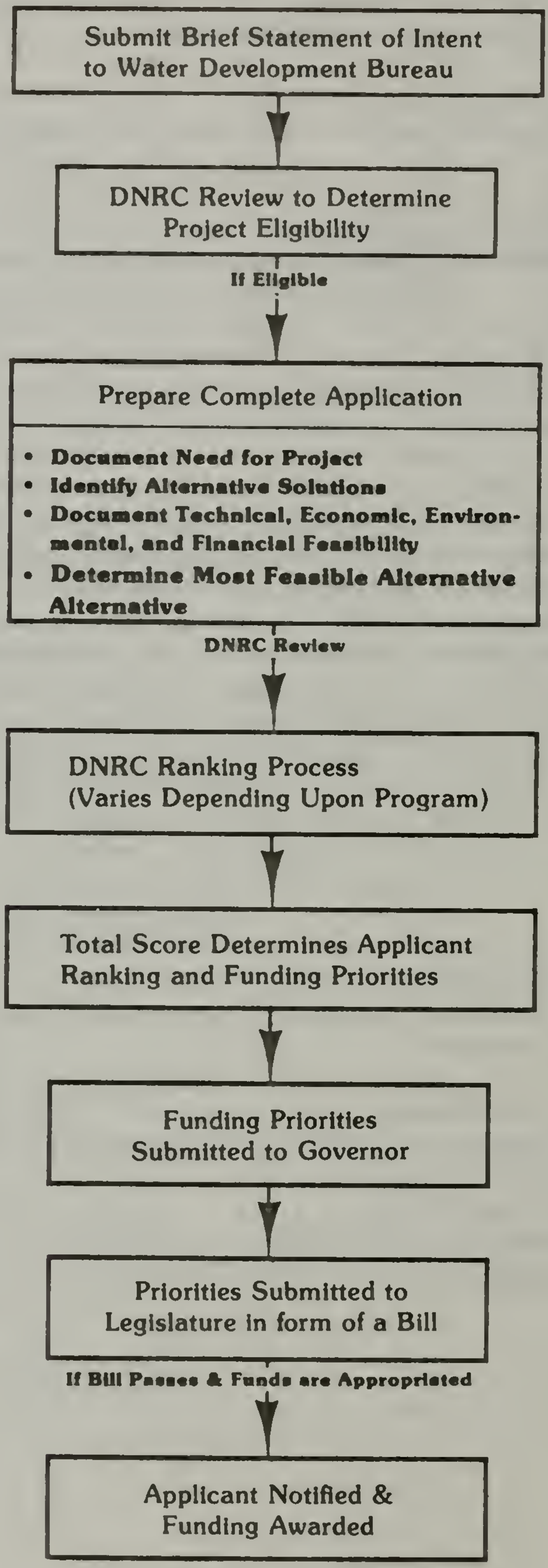
Each program goal is weighted equally, and proposals may receive from 0 to 10 points for each category, depending on the project's relationship to the particular goal. The total point score for all seven program goals is then used to determine recommended funding priorities among all program applicants. The recommendations for project funding are then submitted to the Governor, who in turn submits them to the Legislature in the form of a proposed law. If the law passes both Houses and is signed by the Governor, RRD funds will be appropriated for a period of two years, beginning on July 1 after each Legislative session. After the law is enacted, successful applicants will be notified and DNRC will prepare a contract for the administration and disbursal of funds. Figure 5 depicts the application, ranking, and award procedures of the Renewable Resource Development Program.

e. Program Contacts

For more information regarding Renewable Resource Development grants and loans, contact:

Caralee Cheney
Department of Natural Resources and Conservation
Water Development Bureau
28 South Rodney
Helena, Montana 59620
Telephone: (406) 449-3760

Figure 5: DNRC Renewable Resource & Water — Development Programs Application Procedures


Submit Brief Statement of Intent to Water Development Bureau
DNRC Review to Determine Project Eligibility
If Eligible
Prepare Complete Application
• Document Need for Project
• Identify Alternative Solutions
• Document Technical, Economic, Environmental, and Financial Feasibility
• Determine Most Feasible Alternative Alternative
DNRC Review
DNRC Ranking Process (Varies Depending Upon Program)
Total Score Determines Applicant Ranking and Funding Priorities
Funding Priorities Submitted to Governor
Priorities Submitted to Legislature in form of a Bill
If Bill Passes & Funds are Appropriated
Applicant Notified & Funding Awarded

C. Water Projects

1. DNRC WATER DEVELOPMENT PROGRAM

a. General

The Water Development Program, created in 1981 by the Montana Legislature, is administered by the Water Development Bureau, Water Resources Division, Department of Natural Resources and Conservation (DNRC). Its purpose is to promote and advance the beneficial use of water, and to allow the citizens of Montana to achieve full use of the state's water by providing extensive financing for water development projects and activities. This is accomplished through the use of coal severance tax funds and bond proceeds used to make loans or grants to local governments, state agencies, or private entities. Eligible private applicants include individuals, associations, and corporations. Funding for the Water Development Program is allocated each biennium.

The program is funded by an earmarked percentage (0.625% of the gross proceeds) of the coal severance tax; funding is projected to be $616,588 for FY 1984 and $769,169 for FY 1985. In addition, DNRC can issue up to $5 million in general obligation bonds to provide additional monies for loans. These loans are made available at approximately the same interest rate at which the bonds are sold, and must be repaid over a period not exceeding 30 years or the life of the project, whichever is less. A $250 million revenue bonding authority backed by the coal severance tax trust fund may also be used to provide additional funding for larger projects. These loans must be repaid over the same term as those backed by the general obligation bonding authority. Loans from both sources to public entities must be approved by the Legislature. Loans to private individuals are available throughout the biennium.

There are statutory limits on the size of loans and grants. Loans are limited to the lesser of $100,000, 10 percent of the funds available for loans, or 80 percent of the fair market value of the security given for a loan. Grants to private entities are limited to 25 percent of the project cost, or 5 percent of available funds. There is no limit on grants to public entities, unless the project demonstrates a repayment capacity. In this case, there is a limit of 25 percent of the total project cost.

b. Eligibility Requirements

Any division of state government, as well as cities, counties, and all other subdivisions of local government are eligible to receive funds from this program. In addition, private applicants including individuals, associations, corporations, or other non-governmental entities not eligible for a loan or grant as a public body may receive Water Development Program funds.

Proposed projects and activities must be water-related, and may be for feasibility work or construction. Specifically, projects may deal with hydropower development, construction or rehabilitation of irrigation projects, construction of dams and reservoirs, control of saline seep, development of water-based recreation facilities and opportunities, stabilization of streambanks and erosion control, development of water supply, water treatment or rural water systems, and development of water conservation measures such as conversion from pumped to gravity sprinkler systems.

In order for a project or a proposed activity to be considered for funding through the Water Development Program, the proposal must advance the objectives of the program; be located in Montana; be economically feasible; be multi-purpose as far as practical; comply with statutory and regulatory standards; and provide public benefits as a result of the proposal.

c. Application Procedures

Eligible applicants are required to undertake a two-step application process similar to that previously described for DNRC's Renewable Resource Development Program. The initial step involves the drafting and submission of a brief statement of intent to DNRC for a determination of project eligibility. If the project is eligible for program funding, a full application must be prepared demonstrating the technical, economic, environmental and financial feasibility of the proposal. The applicant must also document the need for the proposed project, evaluate alternatives, and select the least expensive, yet feasible alternative. This information is then submitted to DNRC for review and project ranking to determine funding priorities. Applications must be submitted prior to June of the year preceding the regular Legislative Session.

d. Ranking and Approval Process

DNRC utilizes a point system to evaluate the proposal's conformance with ten designated program goals. Each program is equally weighted, and proposals are awarded between 0 and 10 points for each category, depending upon how well the proposal meets the goal. The program goals used to rank proposals include:

Provision of Public Benefits

* Projects must result in benefits to the public health, natural environment, or economic environment

Family Farm Projects

* This goal considers the benefits the project will afford to family farms

Use of Reserved Water

- * This goal considers projects which utilize or develop reserved water

Conservation and Use of Water

- * This goal considers projects which will promote conservation and the efficient use of water

Urgency and Need

- * This goal considers the extent to which the project alleviates immediate or anticipated problems

Environmental Feasibility

- * This goal considers the environmental consequences of the proposed project

Degree of Multi-Purpose Use

- * This goal considers the benefits that the project offers to a variety of users

Protection of Prime Agricultural Lands

- * Projects are preferred that will not take prime agricultural lands out of production

Water Storage

- * New water storage projects or projects that will ensure the continuation of water storage are desirable

Geographic Balance of Funding

- * Projects are preferred that allow a geographic balance of project funds

Points are totaled for each of the ten categories and the accumulated total is used by DNRC to determine recommended funding priorities among all applicants. These recommendations are forwarded to the Governor and ultimately to the Legislature in the form of a proposed law. If the Legislature passes the law and it is signed by the Governor, funds will be appropriated for the biennium and allotted to successful applicants.

The DNRC also attempts to divide funds equally between water "projects" which include all physical facilities for conserving, distributing, developing, storing and utilizing water for beneficial uses; and water "activities" which include actions or projects designed to promote or enhance water resources through efficient use, management, and protection of Montana's water.

Successful applicants will receive funding several months after the Legislature adjourns (usually July 1). Decisions on proposals from private applicants are made by DNRC's Director, and are funded with monies made available through a block of funds appropriated by the Legislature.

Once the funding decisions have been made, DNRC enters into contracts with the sponsors of funded projects. These contracts provide a detailed scope of work, defining the work to be accomplished and setting project milestones, which are tied to disbursement of funds. They also provide for quarterly reports from project sponsors; these reports are used, in conjunction with field visits, to monitor progress. DNRC staff expertise is available to ensure acceptable progress on the projects. Procedural requirements of DNRC's Water Development Program are similar to those previously depicted in Figure 5.

e. Program Contacts

Information regarding DNRC's Water Development Program may be obtained by contacting:

Caralee Cheney
Department of Natural Resources and Conservation
Water Development Bureau
28 South Rodney
Helena, Montana 59620
Telephone: (406) 449-3760

D. Sewer Projects

1. EPA CONSTRUCTION GRANTS PROGRAM

a. General

The Construction Grants Program was established to carry out the intent of the Federal Water Pollution Control Act of 1972 (Public Law 92-500), which is to preserve the quality of our nation's waters through the cooperation of local, state and federal agencies charged with that responsibility. The 1972 law has been amended several times, and is now commonly referred to as the Clean Water Act (Public Law 97-117). The primary purpose of the grant assistance available under the Construction Grants Program is to protect the public health and to assist municipalities in meeting the enforcement requirements of the Clean Water Act, in particular the National Pollutant Discharge Elimination System (NPDES) permit requirements. The Environmental Protection Agency (EPA) is authorized under the Clean Water Act to provide grant assistance to municipalities for the development of wastewater treatment projects. The Montana Department of Health and Environmental Sciences (MDHES) Water Quality Bureau has been delegated the responsibility for administration of the Construction Grants Program.

The Construction Grants Program is strictly a reimbursement grant program consisting of three phases or steps. Step 1 involves facilities planning to determine the most environmentally sound and least costly project a community should build. Step 2 is the project design phase, which includes the preparation of construction drawings, specifications and other contract documents. Step 3 involves the construction of the project. Facilities planning and design costs (Steps 1 and 2) must be paid for by the community; however, a part of these costs are reimbursed through an allowance at the time the Step 3 grant is made. Communities of less than 25,000 population with projects costing $8 million or less may be awarded Step 2 and Step 3 funding, which includes an allowance for design costs and construction. Communities with less than 10,000 population that have funding problems which would prevent them from preparing a request for a construction grant may be eligible to receive advance funding to cover planning and design costs.

The program provides grants to eligible applicants up to 75 percent of allowable project costs until September 30, 1984. After that date, only 55 percent of the allowable project costs will be eligible for funding. The federal grant share may be increased by an additional 20 percent for innovative or alternative technology projects; however, funding in no case may exceed 85 percent. Although only 15 to 25 percent of the total is required for the local share, the additional time and effort required of the grantees to assure compliance with federal requirements of the program and the non-reimbursable items present in most projects cause the local matching share to be approximately 30 to 35 percent for most communities. There are no restrictions placed on the source of these local funds. The Construction Grants Program is funded through Congressional approval of an annual Appropriations Bill. If the bill is delayed in Congress, program funding may also be delayed.

b. Eligibility Requirements

The applicant must be a public body created under state law, and must have the legal authority for the disposal of sewage, industrial wastes, or other wastes. Eligible applicants may also include authorized Tribal organizations but not special districts which do not have as a principal responsibility the treatment, transport or disposal of liquid wastes. Although special districts may not apply for construction grants, they may be formed to underwrite the local matching share required by the program.

Eligible projects include collection systems, intercepting sewers, wastewater treatment facilities, outfall sewers, infiltration/inflow rehabilitation, and the correction of combined sewer overflows. After September 30, 1984, eligible projects will include only intercepting sewers, wastewater treatment facilities, outfall sewers, and infiltration/inflow rehabilitation projects. After this date, states may use up to 20 percent of their allotment to fund previously eligible projects.

c. Application Procedures

In order to receive a Step 3 construction grant, the applicant must file an application for grant assistance which includes documentation of completed Step 1 and Step 2 requirements. The application must include a facilities plan prepared in accordance with EPA and MDHES regulations including the identification and mitigation of all environmental impacts; certification that there has been adequate public participation; A-95 Clearinghouse comments; evidence of compliance with all limitations on award of program funds; construction plans, specifications, and project schedule; a draft plan of operation; and legal documentation of additional properties, if the project requires the acquisition of other property. Several forms must be completed and included in the application package. These forms include:

- Form 5700-32 (Application for Federal Assistance)
- Form 5700-41 (Cost of Price Summary)
- Form 5700-4 (Compliance Report)
- Form 5700-1 (Assurance of Compliance)

Technical assistance regarding application procedures is provided by the MDHES Water Quality Bureau. The EPA has also prepared an extensive list of publications that explain in detail all three steps of the Construction Grants Program. These publications are available through MDHES or directly from the U.S. Department of Commerce, National Technical Information Service (NTIS) at the following address:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

d. Ranking and Approval Process

The Montana Department of Health and Environmental Sciences is aware of communities that are in need of improved wastewater facilities through its inspections of wastewater facilities, its frequent travel throughout the state, from community correspondence and MPDES activities. Communities in need of such facilities are placed on a priority list according to an EPA-approved rating and ranking procedure. The system used by MDHES must consider three criteria in its determination of priority applicants. These include: 1) the impairment of classified water uses resulting from existing municipal discharges; 2) the extent of ground or surface water use restoration or public health improvement resulting from the reduction in pollution; and 3) the necessity of other administrative management or public participation procedures in relation to the proposed project. If a community is not placed on the list but wishes to be included, it must submit a written request to MDHES for consideration. The ranking is reviewed quarterly and the priority list prepared at least once per year. Copies of the ranking system and priority list are available upon request from MDHES.

Communities on the priority list are encouraged to submit a full application when they advance to a position high enough on the list to receive funding. After the full application is reviewed and approved by MDHES, it is then submitted to EPA for the grant award. EPA has 45 days in which to approve or disapprove the application. If EPA action (approval or disapproval) does not occur within 45 days, the application will be deemed approved, subject to available appropriations. The EPA Construction Grants Process is summarized in Figure 6.

e. Program Contacts

Information and assistance regarding the Construction Grants Program may be obtained by contacting:

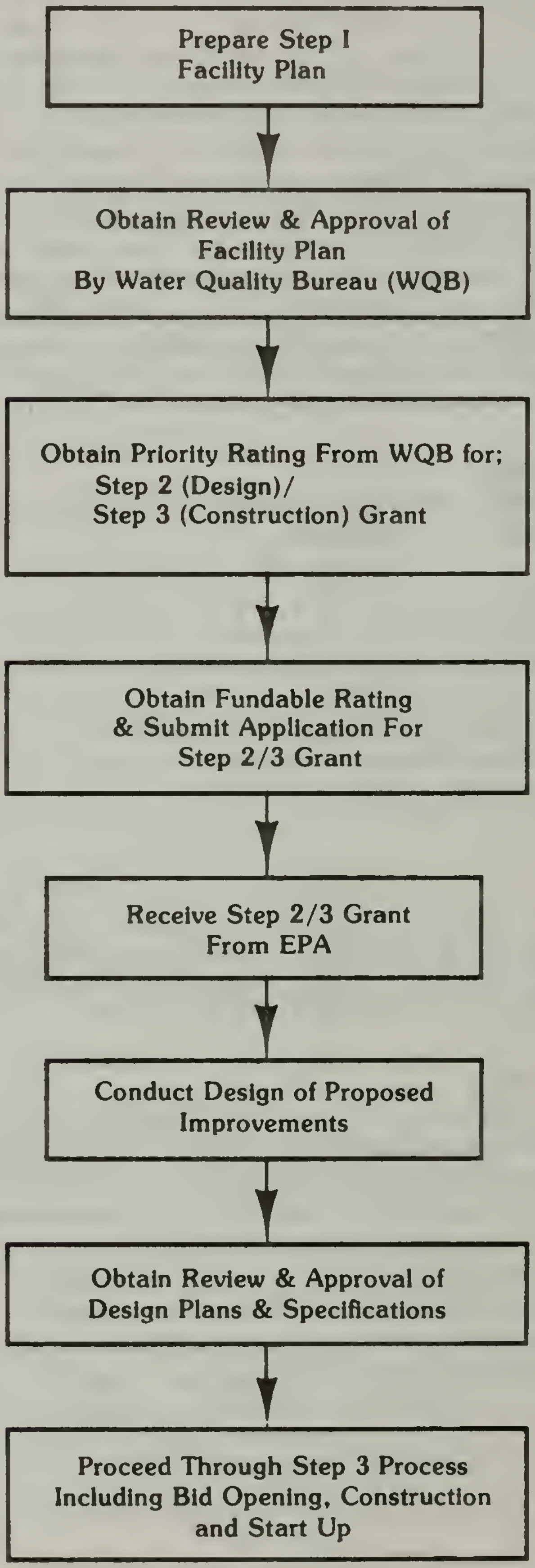
Joe Steiner
Wastewater Construction Grants Program
Montana Department of Health and Environmental Sciences
Water Quality Bureau
Cogswell Building, Room A-206
Helena, Montana 59620
Telephone: (406) 449-2406

E. Summary of Federal and State Programs For Water and Wastewater Projects

1. SUMMARY TABLE

The primary features of each of the major federal and state programs available to communities for water and wastewater systems are summarized in Table 1. This table presents the basic eligiblity requirements, financial information, ranking criteria, and other requirements of each program. The purpose of this table is to enable local officials to quickly determine if federal or state funding assistance may be available for a desired project. Individual program guidelines should be thoroughly researched to determine if the community and the project meet the destailed eligibility requirements of each program.

Figure 6: Environmental Protection Agency Construction Grants Process


Prepare Step I Facility Plan
Obtain Review & Approval of Facility Plan By Water Quality Bureau (WQB)
Obtain Priority Rating From WQB for; Step 2 (Design)/ Step 3 (Construction) Grant
Obtain Fundable Rating & Submit Application For Step 2/3 Grant
Receive Step 2/3 Grant From EPA
Conduct Design of Proposed Improvements
Obtain Review & Approval of Design Plans & Specifications
Proceed Through Step 3 Process Including Bid Opening, Construction and Start Up

Note: For Projects with estimated Construction costs exceeding $8 million, Separate Grants, for Step 2 and Step 3 must be nbtained.

Program	Eligible Applicant	Special Requirements	Program Contact
Water & Waste Disposal Loans & Grants (FmHA)	Counties & Municipali Special Purpose Distri Cooperatives Non-Profit Corporatio Fed-recognized Indian	Applicants Must be Unable to Finance Project by Other Means	Tad Habnass/John Olarud Community Facility Loan Program FmHA P.O. Box 850 Bozeman, Montana 59715 (406) 587-5271
Renewable Resources Development Program (DNRC)	Counties & Municipali Commissions, Boards, Agencies, Dept. Private Individuals	Technical, Economic, Environmental, and Financial Feasibility of Project Must be presented	Caralae Chenay Department of Natural Resources & Conservation Water Development Bureau 28 South Rodney Helena, Montana 59620 (406) 449-3780
Water Development Program (DNRC)	Counties & Municipali Other Gov't. Subdivisi Private Individuals Associations & Corpo		
Construction Grants Program (EPA/MDHES)	Municipalities Certain Public Entitie Authorized Tribal Organizations	Must Get on Priority List Document Health/Pollution Problems	Joa Stainar Construction Grants Program MDHES Water Quality Bureau Cogswell Building, Room A-206 Helena, Montana 59620 (406) 449-2406
Montana Coal Board Grant & Loan Program	Local Governmental U State Agencies Special Districts Water/Sewer Districts Fed-recognized Indian	Property Taxes cannot be Used to Repay Loan	Murdo Campbell Montana Coal Board Department of Commerce 1424 Ninth Avenue Helena, Montana 59620-0401 (406) 449-2400
Community Development Block Grants (Commerce)	Incorporated Cities/To Counties	Must Meet General and Specific Threshold Requirements	Dava Cola/Bobbi Balaz-Devis Department of Commerce Economic & Community Development Division 1424 Ninth Avenue Helena, Montana 59620 (406) 449-3757

TABLE 1: SUMMARY OF FEDERAL & STATE PROGRAMS FOR WATER & WASTEWATER PROJECTS

Program	Eligible Applicants	Eligible Projects	Local Match	Loan/ Grant	Pre-Application Req'd	Planning Costs Covered	Funding Level	Loan Repayment Period	Ranking Criteria	Funding Cycle	Special Requirements	Program Contact
Water & Waste Disposal Loans & Grants (FmHA)	Counties & Municipalities Special Purpose Districts Cooperatives Non-Profit Corporations Fed-recognized Indian Tribes	Water & Wastewater Systems (Construction, Repair, Expansion)	No	Both Loans and Grants	Yes	Reimbursement as part of Total Project Cost	No Maximum Loan 75% Maximum Grant	40 Years or Life of Facility	Priority to: Under 5,500 pop., Health Risks, Facility Expansion	Continuous Cycle	Applicants Must be Unable to Finance Project by Other Means	Ted Habnass/John Olarud Community Facility Loan Program FmHA P.O. Box 850 Bozeman, Montana 59715 (406) 587-5271
Renewable Resources Development Program (DNRC)	Counties & Municipalities Commissions, Boards, Agencies, Dept. Private Individuals	Water or Wastewater Projects (Feasibility, Development, expansion, Construction)		Both Loans and Grants	No	Yes	$200,000 Loan	30 Years or Life of Facility	Enhance Public Resources Optimize Public Benefit Need/Urgency Feasibility State-wide Applications Prior RRD Funding	Application Due in June of Years Preceding Legislative Session (1884 & 1886)	Technical, Economic, Environmental, and Financial Feasibility of Project Must be presented	Caralee Chaney Department of Natural Resources & Conservation Water Development Bureau 28 South Rodney Helena, Montana 59620 (406) 449-3760
Water Development Program (DNRC)	Counties & Municipalities Other Gov't. Subdivisions Private Individuals Associations & Corporations	Water-Related Projects (Feasibility, Development, Construction)	No	Both Loans and Grants	No	Yes	$100,000 Loan 25% of Costs — Private Entities 25% for Projects With Repayment Ability	30 Years or Life of Facility	Multi-Purpose Use Water Storage Public Benefit Need/Urgency Conservation Feasibility Geographic Balance			
Construction Grants Program (EPA/MDHES)	Municipalities Certain Public Entitites Authorized Tribal Organizations	Wastewater Systems (After 9/30/84 only Interceptors, Treatment Facilities, Outfall Sewers, and Infiltration/Inflow Rehabilitation will be Eligible.)	Yes	Grant	No	Reimbursement In Step 3 Funding	Grants to 75% (After 8/30/84 only 55% will be Fundable.) Grant May be Increased by 20% For Innovative/ Alternative Technology	Not Applicable	Impairment of Water Uses Extent Project Will Restore Water Quality Public Health Improvement	Applications Due July 1	Must Get on Priority List Document Health/Pollution Problems	Joe Steiner Construction Grants Program MDHES Water Quality Bureau Cogswell Building, Room A-206 Helena, Montana 59620 (406) 449-2406
Montana Coal Board Grant & Loan Program	Local Governmental Units State Agencies Special Districts Water/Sewer Districts Fed-recognized Indian Tribes	Water & Wastewater Systems		Grants to 80% Loans	Yes	No. Funding may be Available from County Land Planning Funds	No Limitations (Project Cost Estimates Will be Reviewed by Board.)	20 Years	Need Severity of Impact Availability of Funds Local Effort	Continous Cycle (Applications Due 30 Days Prior to Meetings)	Property Taxes cannot be Used to Repay Loan	Murdo Campbell Montana Coal Board Department of Commerce 1424 Ninth Avenue Helena, Montana 59820-0401 (406) 449-2400
Community Development Block Grants (Commerce)	Incorporated Cities/Towns Counties	Economic Development Housing Public Facilities (Water & Wastewater Systems)	No	Single Purpose Grants Comprehensive Grants	No	Yes	$400,000 — Single Purpose Grant $500,000 — Comprehensive Grant	Not Applicable	Need Appropriateness Impact Benefit to Low & Moderate Income Households	Yearly (1984 Applications tentatively Due in February, 1984.)	Must Meet General and Specific Threshold Requirements	Dave Cola/Bobbi Balaz-Davis Department of Commerce Economic & Community Development Division 1424 Ninth Avenue Helena, Montana 59620 (406) 449-3757

IV

IV

IV

Part IV: Basics of Financing

A. Introduction

The provision of public facilities and services for the benefit of all citizens in the community is one of the primary functions of local government. Since the capital facilities necessary to provide these services are expensive and local financial resources are generally limited, local governments have developed a variety of approaches to allocating their resources for capital purposes. Most federal and state assistance programs for community water or sewer projects require that some portion of the project cost be borne by the community. Often the best (and only) way that a community can provide this local matching share of large capital projects is through debt financing. Debt financing may occur over the long term through the issuance of municipal bonds, which are interest-bearing promises to pay a specific sum of money (principal amount) on a specified date or dates in the future, or by short-term borrowing measures such as loans, warrants or notes. Borrowing permits the cost of capital improvements to be shared with those citizens who will be using the facility in future years.

Use of municipal bonding as a financing method has increased throughout the country over the last three decades due to increasing populations and the related demand for public services. Since municipal officials and citizens are often called upon to make decisions regarding these long-term financial commitments, the following narrative is intended to provide an overview of the "basics" of municipal bonding in terms of issuing procedures, requirements, and usage. Subsequent sections of this chapter will discuss short-term and interim financing methods, local revenue sources, and special purpose districts.

B. Long-Term Financing

1. TYPES OF MUNICIPAL BOND OFFERINGS

In general, there are four major types of municipal bond offerings commonly used in Montana. These include: 1) general obligation bonds; b) revenue bonds; c) special assessment bonds; and d) refunding bonds. The type of bond issued to finance a community's improvements depends in part on the historical use of bonding in the community and the circumstances surrounding the bond offering. The following narrative briefly defines each of the major bond types.

a. General Obligation Bonds

General obligation bonds pledge the unlimited taxing power and the full faith and credit of the issuing government to meet the required principal and interest payments. The amount of general obligation debt that a community can issue is limited by Montana statutes. These bonds are most often used to finance capital projects which benefit the entire community over a long period of time (generally 20 years). An election is required to obtain voter approval prior to the issuing process. The bond issue election is caused by the presentation of a petition signed by a percentage of voters (usually 15%) or by the unanimous consent of the governing body.

b. Revenue Bonds

These bonds pledge the revenue from a particular source (most often the revenue from the facility to be constructed) to meet the principal and interest payments. The bonds are issued without the full faith and credit of the issuing government. The debt a community undertakes by the issuance of revenue bonds is not subject to Montana limitations on bonded indebtedness. Community-wide sewer and water projects are most often funded by revenue bonds.

c. Special Assessment Bonds

Special assessment bonds are issued to pay for public improvements where the property benefited by the improvements can be identified. The principal and interest payments are made from a special assessment on the identified properties. These bonds are issued in conjunction with the formation of special improvement districts, and are typically backed by special improvement district or rural improvement district revolving funds.

d. Refunding Bonds

Refunding bonds are bonds issued to retire an already outstanding bond. These bonds do not represent a different method of financing a new project; however, they do allow for refinancing of a prior project. The bonds may either be general obligation bonds or revenue bonds, and are issued to: 1) shorten the term of the outstanding bond issue; 2) take advantage of more favorable interest rates; 3) eliminate restrictive covenants on the primary issue; 4) reorganize the maturity schedule of a bond issue; or 5) consolidate community debt. The debt is not subject to limitations on bonded indebtedness.

2. DESCRIPTION OF A MUNICIPAL BOND

As previously mentioned, a bond is a certificate representing a promise from the issuer to pay a specified sum of money (face value or principal amount) at a specified date or dates in the future with periodic payments of interest at a specified rate. Municipal bonds are identifiable by four items which include: a) the name of the issuer; b) the interest rate; c) the maturity structure; and d) the yield or price. These items are common to all bond issues and are keys to understanding the municipal bonding process. Later sections of this chapter will discuss other features that are commonly associated with the issuance of bonds.

a. Name of Issuer

The first essential item contained on any bond is the name of the issuer. In most cases, bonds issued to pay for the costs associated with water or sewer systems will be issued by either county or municipal governments. The board of directors of county water and/or sewer districts has the authority to issue bonds after approval is granted through a public referendum. Local governments also issue bonds to pay for projects undertaken through the formation of special or rural improvement districts, and are repaid through assessments to property owners in the districts.

b. Interest Rate

The interest on a bond is the compensation paid or to be paid for the use of money. Interest is most commonly expressed as an annual percentage rate. In the case of municipal bonds, interest is paid semiannually by the issuer to the bondholder (investor). Fixed-income securities such as municipal bonds have interest rates which are fixed at the time the bond is issued and remain the same over the life of the bond. Interest rates depend on the credit rating of the community; the type, size and risk of the investment; and the maturity structure of the bond.

c. Maturity Structure

The maturity structure of a bond issue identifies the dates upon which the investor will receive payments of principal and interest. This structure is basically determined from the annual need for cash and the length of time the debt will extend. As a general rule, money should not be borrowed for longer than the life of the capital improvement it will purchase. In the case of water or sewer facilities, the bond should be repaid while some useful life remains in the facility. The maturity structure (or repayment pattern) that a community selects should consider the existing debt retirement structure, expected revenues during the repayment period, and the rate at which the community will receive benefits from the new facility. The repayment patterns used by communities are classified as serial maturity, term maturity, or irregular maturity.

Serial maturity structures allow the principal to be repaid in periodic installments over the lifetime of the issue. This structure allows for repayment of equal amounts of principal each year, which in turn reduces annual interest costs. Term maturity structures require that only annual interest payments be made to bond holders and that the principal amount borrowed be repaid in one lump sum when the bond reaches final maturity. The principal amount of the bond issue may be repaid from funds set aside in a special fund established for debt retirement (sinking fund), or with newly borrowed funds. Bonds may also be issued with irregular maturity structures in which repayment of principal and interest may follow any schedule. This maturity structure allows local governments to tailor the repayment of debt to fit the anticipated future situation of the community.

d. Yield

The yield of a municipal bond refers to the return the bond purchaser receives on his investment. This yield reflects the interest rate, length of time to maturity, and whether the bond was purchased at a premium or discount. Since the interest payment is fixed, the price of bonds available to investors must change in order to keep the yield competitive with other newly issued bonds. The yield from municipal bonds may fluctuate due to changes in the economy, changes in the creditworthiness of the issuer, or changes in the demand for bonds by investors. Yield is most often discussed in terms of "current yield" or "yield to maturity". "Current yield" is the relationship of the annual interest to the actual market price, stated as a percentage. This relationship gives investors a quick and simple measure of the current income on a bond earned from interest payments. The "yield to maturity" is a measure of the net annual return on the municipal bond from purchase to final maturity. This measure of yield is the most indicative to investors in the bond market.

3. OTHER BOND PROVISIONS

There are several other important features and practices that are commonly associated with municipal bonds. While these items are less basic than those previously mentioned, these characteristics are fundamental to a working knowledge of municipal bonds. These items include: a) call provisions; b) bond ratings; and c) bond registration.

a. Call Provisions

Call provisions are a type of bonding provision which permits the issuer to pay the obligation prior to the stated maturity date on the bond. Bonds with this provision usually have a "call date" which gives the earliest date that the issuer can redeem the bond. Call provisions allow local governments to take advantage of any significant drop in interest rates to refinance debts.

Investors are usually willing to purchase callable bonds only at higher interest rates than non-callable bonds of a similar nature; or they may require a call premium, which is an additional amount payable to the bond holder if the bond is called by the issuer. Bond issues are attractive to investors, in part because they represent an opportunity to obtain a fixed income for a number of years. If bonds are callable, investors may not realize this anticipated income. As a result, investors may hesitate to purchase callable bonds unless some incentive such as higher interest rates or call premiums are offered.

b. Bond Rating

A bond rating is a description of a local government's creditworthiness as determined by a bond rating agency. Many local governments use their rating to increase the marketability of a particular bond issue. The two nationally recognized bond rating agencies are Moody's Investors Service, Inc. and Standard & Poor's Corp., both of which are located in New York City. Ratings are also used by investors to gain a relative indication of the quality of investment that a bond offering presents. Bonds are usually rated as investment grade or below investment grade, with various degrees comprising each category. In general, the higher the bond rating, the lower the interest costs to the issuer of the bond. Many small communities may not have their bonds rated if potential interest savings from offering rated bonds do not offset the cost of obtaining the bond rating or if the issue is small. One of the best ways for a community to obtain a favorable bond rating is to demonstrate careful long-range planning, accurate recordkeeping, and a historical pattern of prompt debt retirement. Any bonds sold under a private sale to a federal agency (e.g., FmHA) or the State of Montana are not rated.

c. Bond Registration

A registered bond is one in which the owner is registered with the issuing governmental unit, and sale or exchange of the bond cannot occur without a change of registration. Bonds are now required to be fully registered as to principal and interest or as to principal only. There are no coupons attached to the bonds, and the payment of principal and interest will automatically be made to the registered owner. Effective July 1, 1983, all tax-exempt public obligations issued by state or local governmental units in Montana are required to be fully registered as to principal and interest.

4. BOND UNDERWRITING AND MARKETING

Due to the size of most municipal bond issues, single investors are not generally available or willing to purchase the entire offering themselves. As a result, municipal bonds are most often purchased by an underwriter or a syndicate of underwriters. The underwriter is usually an investment house that serves as an intermediary between the issuing government and potential investors. The underwriter agrees to purchase the entire bond issue in hopes of reselling the individual bonds to investors at a profit. There are two types of underwriting; negotiated and competitive.

Negotiated underwriting occurs when an underwriter is selected as the bond issue is being formulated. Representatives of local government, the underwriter, and the fiscal consultant (if one is retained by the issuer) cooperatively agree on the interest rate that will be paid on each maturity date. Negotiated underwritings are often used for revenue bond issues; however, Montana statutes prohibit negotiated revenue bond sales. Under certain circumstances, a federal agency may underwrite a bond issue. For example, the Farmers Home Administration may underwrite all or part of a community's bond offering to construct or improve water and sewer facilities if agency and program requirements are met.

Underwriting may also be undertaken on a competitive basis. The underwriter selected to purchase the bonds is the one who offers to buy them at the lowest interest cost. The community may solicit bids from all interested underwriters. The number of interested underwriters in competition for the bid offering depends on the size and quality of the bond issue. An underwriter's bid states the annual interest rate the community will pay for bonds maturing each year and the amount of principal the underwriter will provide to the community. The bid is based on the characteristics of the community, its outstanding debt, credit rating, characteristics of the particular issue, and upon what the underwriter feels the investors will be willing to pay when the bonds are resold. Competitive underwriting is used to select underwriters for most general obligation and revenue bond issues.

Depending on the type, municipal bonds may be underwritten at par, discount, or premium. Bonds are underwritten at par when the underwriters provide the community with the exact amount borrowed. If the underwriters provide the community with less than the principal amount borrowed, the bonds are said to be underwritten at a discount. Likewise, if an underwriter provides the community with more than the principal amount borrowed, the bonds are underwritten at a premium. Montana states do not permit communities to sell bonds at a discount. The cost to investors that an underwriter may offer is directly attributable to whether or not bonds have been underwritten at par, discount, or premium. For example, if bonds are underwritten at a discount, they will most likely be offered to investors at close to par, or their stated face value. Similar resale patterns may be expected by investors if bonds are underwritten at par or at a premium.

5. SERVICING THE BOND ISSUE

Once the bonds are delivered to the investor, the only contact between the issuer and the investor is through the Paying Agent, Registrar, or Transfer Agent. Paying Agents are almost always banks which are responsible for sending interest and principal repayments to investors and for keeping accounting records of all transactions involving investors. Communities should not insist that local banks be the designated Paying Agent because most local banks are not staffed or well-equipped enough to handle the large number of transactions most bond issues require, especially registered bond issues. Bond Registrars are often the financial officer of the local government (treasurer or town clerk) in the case bearer bonds or the duties may be the responsibility of a financial institution. The Registrar is responsible for making certain that the amount of bonds in circulation is equal to the amount of outstanding debt. Transfer Agents are responsible for making certain that bonds are transferred in a proper manner in the event of sale or exchange. The duties of the Paying Agent, Registrar and Transfer Agent are typically defined in the Bond Resolution, and may be undertaken by the same financial institution.

6. REQUIRED TIME FRAME FOR BOND ISSUES

The amount of time required to prepare and issue bonds is dependent on the size and complexity of the bond issue and whether or not the community is prepared to begin the debt issuing process. Typically, approximately six months are required between the time that local officials post notice of a meeting to consider improvements and the time the community receives the money. If an election is required to approve the bond issue, an additional six months to a year may be necessary to obtain funds for the project. An additional three to six months may be required if project feasibility studies are needed.

7. REQUIRED DOCUMENTATION

A number of documents must be prepared by local officials in conjunction with any bond offering. Much of this documentation is required by state law; however, some documentation is prepared to enhance the marketability of the bond issue. In addition to the bond certificate itself, which contains a summary of the many terms and conditions of the bond issue, other documentation may be necessary, depending on the type of bond offering. The following narrative briefly discusses this supplemental documentation.

a. Notice of Sale

This document is often the initial step in the process of offering municipal bonds for competitive sale. It specifies the maturity structure, the amount of principal to be repaid at various maturity dates, and the date and time of the bond sale. In addition, the official Notice of Sale indicates the basis of awarding the bid on the bonds, the selection criteria for evaluating underwriter bids, and bid structure requirements.

b. Bond Indenture or Resolution

This document sets forth the maturity date and interest rate of the bond issue, identifies the security for the bonds, describes the rights and duties of the bond purchaser, Registrar, Transfer Agent, and issuer. This document will also describe the provisions for registration, transfer and payment of the bonds.

c. Official Statement

This document is issued in connection with both general obligation and revenue bonds. It describes, in detail, the community, its major industries, largest property taxpayers, outstanding municipal debt, historical tax collection and bond repayment information, and future borrowing plans. In addition, details of the bond issue are discussed, including: 1) the purpose and the amount; 2) type of bond offering; 3) maturity structure, interest payment dates, and call privileges (if any); 4) the time and location of the bidding; 5) the location where the bonds will be delivered; and 6) the name of the community's bond counsel. The Official Statement may be prepared by local government officials, the community's financial consultants, the underwriter or bond counsel, or a combination of these individuals, and is required whenever a bond issue is underwritten on a competitive basis. The Official Statement is intended to inform potential underwriters and investors of the community's ability to repay the money it borrows. Feasibility studies, rate structure analyses and community debt analyses usually form the basis for much of the Official Statement.

d. Legal Opinion

The Legal Opinion is a document certifying that, in the opinion of a specialized bond attorney, the municipal bond issue complies with all legal requirements regarding municipal debt. The Legal Opinion is intended to inform investors that the community has the legal authority to issue the bonds and that the community is legally bound by all provisions in the bond. Typically, the bond counsel is requested to give an opinion that the interest on the bond issue is exempt from federal income taxation. This legal opinion makes the bonds marketable.

e. Feasibility Studies

Feasibility studies often accompany bond issue documents and are generally prepared by an engineer or a Certified Public Accountant. These studies present cost justifications for the proposed project and provide supplementary evidence regarding the community's ability to repay the debt to be incurred, especially if the proposed facility will generate revenue to be used for debt retirement.

8. PROFESSIONAL ASSISTANCE

Communities without specialized legal or financial personnel on staff may require professional assistance to design a bond issue and obtain the required legal documentation. The type of professional assistance needed depends on the size and complexity of the bond offering. Financial consultants can help to evaluate the long-term capital improvements program, design the bond issue, and help in the preparation of all the official documents for bond rating and marketing. Typical services offered to communities by financial consultants include:

- Preparation of information on revenues necessary to retire bonds (reserve funds and sinking funds);
- Recommendation of bond provisions (call features, covenants, maturity structures, etc.) and timing to obtain the lowest possible interest rates;
- Review of outstanding bond indentures;
- Preparation and printing of the Official Statement and Notice of Sale, and distribution to potential investors;
- Bond rating and decisions on the viability of bond insurance;
- Printing of the bonds; and
- Assistance in the delivery of bonds to the initial purchaser.

The primary function of a bond counsel is to advise the issuer on the legal and tax aspects of the bond sale. For every bond issue, the bond counsel's duty is to ensure that the requirements of local, state and federal laws, judicial opinions and enabling legislation or procedures are met so that the bond issue is legal. As previously mentioned, the bond counsel must offer an opinion as to whether the interest earned on the particular bond issue is exempt from federal income taxation. The bond counsel may also be required to make sure the bonds are issued properly.

Professional engineering services are also important to most bond issuance. In the case of water and sewer projects, it is the role of the engineer to determine project costs through preliminary engineering and the design of the project. The amount of bonds needed for the project may be determined by the engineer after construction bids have been obtained, selected, and reviewed.

Since recent legislation requires that all tax-exempt public obligations issued after July 1, 1983 be fully registered, the roles that the Bond Registrar or Transfer Agent play in the servicing of bond issues may increase in importance. In the past, county or city treasurers and town clerks have filled these roles because many bonds were issued as bearer bonds, for which interest was paid upon the receipt of coupons and principal payments made upon presentation of the bond certificate. The new registration requirement imposes more stringent requirements regarding bond ownership and transfer, and may result in increased administrative costs. Communities may benefit from the appointment of an independent Registrar or Transfer Agent rather than utilizing local government staff.

Other general assistance in the preparation of a bond issue may be obtained from the Montana Association of Counties or the Montana League of Cities and Towns. These organizations may provide assistance on technical or legal matters at little or no cost to the community. In addition, these organizations may supply lists of recent debt offerings within the state for reference purposes.

C. Use of Municipal Bonds

1. GENERAL OBLIGATION BONDS

a. Purpose and Usage

The traditional means of financing most large, non-revenue producing capital improvements projects in Montana communities has been through the use of general obligation bonds. These bonds may be issued by local government to finance projects that benefit the entire community for a long period of time. Montana statutes identify the major purposes for which municipalities or counties may incur indebtedness. One such purpose for issuing bonds is for the "construction of sewers, sewage treatment and disposal plants, water works . . ." [7-7-4101(2), MCA]. State statutes limit the amount of general obligation debt that a community may incur to 28 percent of the community's taxable value. Similar limitations are imposed on counties, which may not exceed 11.25 percent of their taxable value for most purposes. City-county consolidated governments may not exceed 39 percent of the taxable value of the property subject to taxation. Special provisions are available to Montana cities and towns that allow them to incur additional general obligation debt for water and sewer system construction over and above the 28 percent debt limit. Municipalities may borrow money or issue general obligation bonds totalling up to 55 percent of the taxable value of property in the community for the express purpose of constructing or improving water and sewer facilities. City-county consolidated governments may issue bonds amounting to an additional 10 percent of the taxable valuation over and above the 39 percent debt limit for water or sewer system construction or improvements.

b. Issuing Procedures

Montana counties and municipalities are subject to virtually the same provisions for issuing general obligation bonds. For discussion purposes, this issuing procedure will be simplified into five stages including the bond issue election, notification of bond sale, bond underwriting, issuance of bonds, and service of the bond issue. Figure 7 depicts the generalized procedure for issuing general obligation bonds in Montana.

i) Bond Issue Election

Local governments may call for an election on the question of issuing general obligation bonds whenever the governing body unanimously consents that the issue complies with the purposes authorized by state law.

The bond issue election may also be initiated through the petition process whereby 20 percent of the registered voters in the county or municipality request that the question be put to the voters for approval in a general or special election. Any proposition relating to water or sewer systems must be submitted to to the public at a bond issue election for approval before any municipality may issue general obligation bonds. If the local government is authorized to submit the proposition of issuing bonds to voters by law or if significant interest in the proposition is indicated by petition, the governing body is required to pass a resolution stating that the question of issuing bonds will be put to the voters in a general or special election. Notice of the election must be published and posted to specify the date and voting hours of the election and to specify the purpose, term and amount of the bond issue. If a majority of at least 40 percent of the registered voters in the municipality or county (depending on the issuing government) favor the proposition, then the proposition will be considered adopted and approved. (Reference: 7-7-4201 through 7-7-4235, MCA for municipalities; 7-7-2201 through 7-7-2237, MCA for counties)

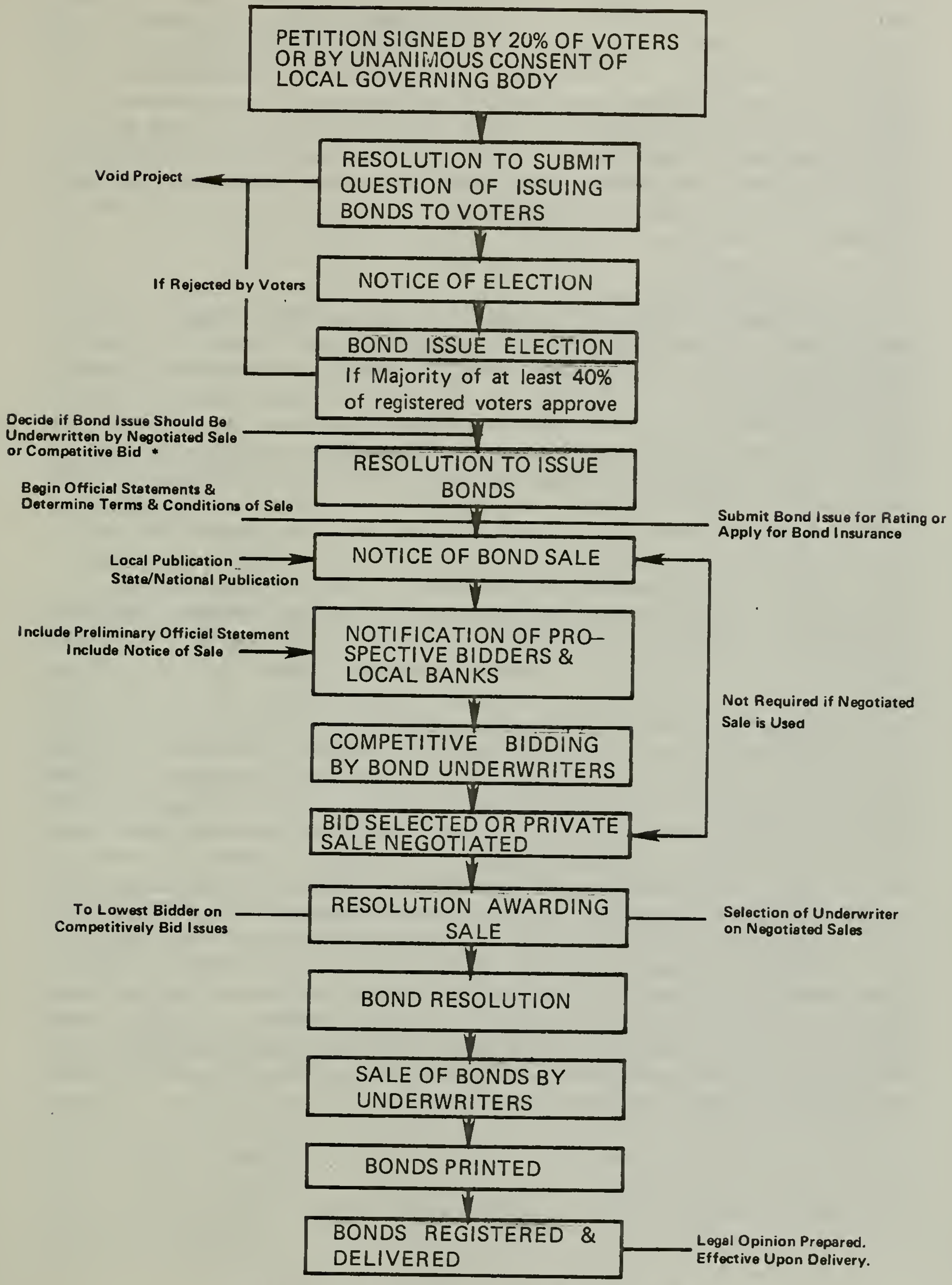
ii) Notification of Bond Sale

After voter approval of the proposition is obtained, the issuing government must pass a resolution to issue bonds which specifies the purpose, amount, term, and other bond requirements. The resolution must also adopt and subsequently publish a "Notice of Sale of Bonds". This notice is a solicitation for bids from bond underwriters and must be published in local newspapers and may be published in other newspapers within Montana or in other states. Notification of a pending bond sale as well as any other information deemed necessary must be supplied to the Montana Department of Administration (Board of Investments) for review at least 15 days prior to the bond sale. (Reference: 7-7-4236 through 7-7-4253, MCA for municipalities; 7-7-2238 through 7-7-2253, MCA for counties)

iii) Bond Underwriting

General obligation bonds are most often underwritten on a competitive bid basis. Bids submitted by underwriters will indicate the type of bond, the annual interest rate that the issuing government will pay for

Figure 7: General Obligation Bond Issuing Process


PETITION SIGNED BY 20% OF VOTERS OR BY UNANIMOUS CONSENT OF LOCAL GOVERNING BODY
RESOLUTION TO SUBMIT QUESTION OF ISSUING BONDS TO VOTERS
Void Project
If Rejected by Voters
NOTICE OF ELECTION
BOND ISSUE ELECTION
If Majority of at least 40% of registered voters approve
Decide if Bond Issue Should Be Underwritten by Negotiated Sale or Competitive Bid *
RESOLUTION TO ISSUE BONDS
Begin Official Statements & Determine Terms & Conditions of Sale
Submit Bond Issue for Rating or Apply for Bond Insurance
Local Publication
State/National Publication
NOTICE OF BOND SALE
Include Preliminary Official Statement
Include Notice of Sale
NOTIFICATION OF PROSPECTIVE BIDDERS & LOCAL BANKS
Not Required if Negotiated Sale is Used
COMPETITIVE BIDDING BY BOND UNDERWRITERS
BID SELECTED OR PRIVATE SALE NEGOTIATED
To Lowest Bidder on Competitively Bid Issues
RESOLUTION AWARDING SALE
Selection of Underwriter on Negotiated Sales
BOND RESOLUTION
SALE OF BONDS BY UNDERWRITERS
BONDS PRINTED
BONDS REGISTERED & DELIVERED
Legal Opinion Prepared. Effective Upon Delivery.

* Montana Statutes Require that all General Obligation Bond Issues be Underwritten by Competitive Bid.

bonds maturing each year. Bonds offered by local government in Montana must be sold at par. The issuing government shall determine and select the bid which is judged to be the most advantageous to its constituents; however, the local government has the option to reject all bids and offer the bonds at a private sale. After a bid is selected, the local government may pass a resolution awarding the sale to the selected underwriter and prescribe the form of the bonds. General obligation bonds may be issued for no longer than 20 years. (Reference: 7-7-4254 and 7-7-4255, MCA for municipalities; 7-7- 2254 and 7-7-2255, MCA for counties)

iv) Issuance of Bonds

This stage of the bond issuing process consists of the printing, registration, and delivery of bonds. The printing of bonds is the responsibility of the issuing government or of the underwriter if printing is included in the bid. After the bonds have been printed, it is the responsibility of the county treasurer, city treasurer, town clerk, or Bond Registrar appointed in the Bond Resolution to register the bonds prior to being delivered to the purchaser. The registration must include the number, principal amount and interest rate of each bond, the issue date, redemption date, if any, and the due date, the amount of principal and interest payments required for each bond with dates for payment specified, and the name and address of the purchaser. Delivery of the registered bonds to the purchaser shall occur at the time full payment is made. (Reference: 7-7-4256 through 7-7-4259, MCA for municipalities; 7-7-2256 through 7-7-2259, MCA for counties.

v) Service of the Bond Issue

All proceeds from the sale of general obligation bonds must be paid to the county treasurer, city treasurer, or town clerk and are immediately available for the purpose for which the bonds were issued. The local government must create a sinking fund for the sole purpose of paying the interest and principal on the outstanding bonds. All revenue collected from taxes issued to repay the bond offering must be credited to the specific sinking fund and used to repay the debt. The sinking fund may be invested (subject to Department of Administration approval) or used to buy back outstanding bonds from bond holders. The issuing government is responsible for the payment of interest or principal from the sinking fund upon presentation of the proper coupon or bond by the bond holder. If revenue in the sinking fund is insufficient, the issuing government has the authority to levy additional taxes to make the required principal or interest payment.

c. Advantages and Disadvantages

i) Advantages

Since the issuing government pledges its unlimited taxing power and its full faith and credit, general obligation bond issues are considered to be secure investments. This fact makes general obligation bond offerings attractive both to underwriters and other investors; however, interest rates on these bonds are frequently lower than other bond types. The primary advantage of issuing general obligation bonds over other bond types is that non-revenue producing projects may be financed over long periods of time. Projects funded through the sale of these bonds generally benefit the entire community for periods of twenty years or more. The outstanding debt is retired over the life of the project from a form of taxation that is equitable to all residents. Any revenue remaining in the sinking fund after principal and interest payments have been made may be invested and used to retire the debt prior to final maturity. Since voter approval is necessary prior to the issuance of general obligation bonds, the expense is generally acceptable to local citizens.

ii) Disadvantages

The extent to which general obligation bonding may be used in Montana is limited by State statutes regarding maximum indebtedness and by the fact that voter approval must be obtained before a local government may issue bonds. Additionally, a default on the bond issue may require the issuing government to levy additional taxes on local residents. The process of issuing general obligation bonds may be quite lengthy due to bond election procedures and the complex credit analysis required to market bonds. This time lag may push back project completion dates and result in increased construction costs. Recent legislation allows local governments to pay fees to underwriters or financial consultants for assistance in putting financing programs together. This may allow local governments to avoid procedural errors and ultimately speed up the process. If property taxes provide the primary source of revenue for debt retirement, the cost of new facilities or improvements to existing facilities may not be paid for by project beneficiaries. Such a situation may occur in areas impacted by energy development where large numbers of temporary workers may be required only during peak construction periods. During this period, the demand for community services may be great and improvements or new facilities may be required to meet the additional demand for services. Since the construction force is temporary, few are likely to become permanent property owners in the community. If the local government issues general obligation bonds to pay for the required services, local residents will be required to repay the issue for many years after the departure of the transient population.

2. REVENUE BONDS

a. Purpose and Usage

Another traditional long-term method of financing capital improvement projects is through the use of revenue bonds. These bonds pledge the monies obtained from a particular revenue source to meet the principal and interest payments of the bond issue. In the past, Montana statutes have limited the use of revenue bonds to municipalities; however, recent legislation has extended the provisions for use of such bonds to include counties. One of the primary purposes for which revenue bonds may be issued is for the acquisition, construction, maintenance and operation of water and sewer systems [7-7-4402(3a) through 7-7-4404, MCA]. Additional provisions are included in the statutes that specifically delegate powers to local governments regarding their role in pollution abatement programs sponsored by any federal or state agency or by private industry (7-7-4405, MCA). The debt incurred by the issuance of revenue bonds is not subject to state limitations on bonded indebtedness.

b. Issuing Procedures

Procedures for issuing revenue bonds are similar in most respects to the provisions for issuing general obligation bonds. The primary difference is that revenue bonds may be issued through a resolution of the governing body, and therefore an election is not required. The governing body, at its own discretion, may submit the question of issuing bonds to the voters for approval. If the issue is submitted to voters, the election must comply with the same provisions that govern general obligation bond issue elections.

Any facility or project financed through the use of revenue bonds is required to be self-supporting. The local government must prescribe (and revise, when necessary) the appropriate fees or service charges to insure that the undertaking remains self-supporting. The fees or service charges must be sufficient to pay all principal and interest costs of the bonds, must provide for operation and maintenance costs, and must provide adequate reserve funds. The proceeds from the sale of bonds must be applied only to the bond issue for which it was intended, and transfer of funds to any other account is prohibited.

The method by which revenue bonds may be underwritten may also vary from that commonly used for general obligation issues. Revenue bonds are commonly underwritten on a competitive basis, whereby underwriter bids are solicited and selected based on which bid has the lowest borrowing costs. State statutes impose limits on several revenue bond provisions for the protection of the issuing government. These provisions require that revenue bonds be sold at par or better; that interest rates be payable semi-annually; and that final maturity not exceed 40 years from the date of issue. (Reference: Municipalities and Counties, 7-7-Parts 43, 44, 45, MCA) Figure 8 depicts the general process for issuing revenue bonds.

c. Advantages and Disadvantages

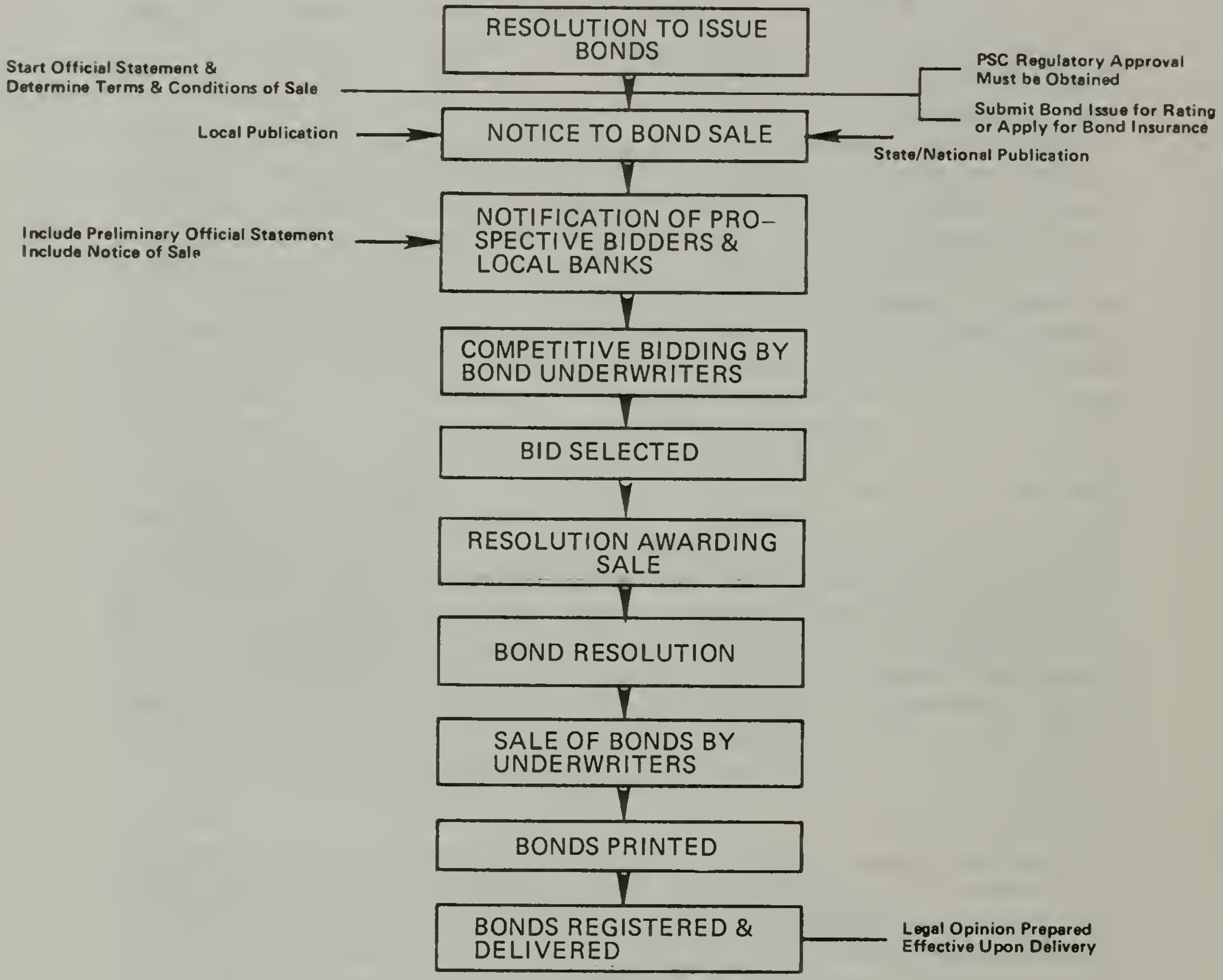
i) Advantages

The major advantage of using revenue bonds over other bond types is that revenue bonds are paid for by the users of the facilities being financed. This feature of revenue bonds constitutes the most equitable method of debt repayment for local citizens and assures that the facilities will be self-supporting through the assessment of user fees or service charges. Use of revenue bonds by local government is also advantageous due to the fact that the debt is not subject to Montana limitations on bonded indebtedness and that a bond election is not required. The credit analysis required for revenue bond issues is more straightforward because payment generally comes from only one source and an analysis of the economic health of the entire community is not necessary. However, the legal and financial protective of the revenue bonds do require close scrutiny. In the event of default, local taxpayers are not burdened with the debt repayment. Another advantage of revenue bonds is that they can be used to finance projects extending beyond municipal boundaries. Generally speaking, revenue bonds may be supported by a pledge of revenues received from operations in any legitimate service area, whether inside or outside the geographical limits of the borrowing governmental unit. Use of revenue bonds allows needed improvements to be undertaken, even if the locality has reached its legal debt limit or taxing limit for general obligation bonds.

ii) Disadvantages

Interest rates are typically higher and the market not as diverse for revenue bonds because revenue bond issues are generally repaid through monies generated by the facility and are not backed by the unlimited taxing powers or the full faith and credit of the issuing government. The legal requirements for issuing revenue bonds are more complicated than that for general obligation bonds due to the fact that restrictive covenants are often attached to the bond which restrict facility operations (e.g., rate covenants). Since Montana statutes require that use of revenue bonds be limited to self-supporting projects or facilities, user fees or service charges may need to be revised several times over the life of the bond issue. Rate structure revisions may be subject to review by the Montana Public Service Commission, and will most likely be greeted by some disapproval by the users of the facility. Most revenue bonds have call provisions that allow the issuing government to re-

Figure 8: Revenue Bond Issuing Process


RESOLUTION TO ISSUE BONDS
Start Official Statement & Determine Terms & Conditions of Sale
PSC Regulatory Approval Must be Obtained
Submit Bond Issue for Rating or Apply for Bond Insurance
Local Publication
NOTICE TO BOND SALE
State/National Publication
Include Preliminary Official Statement
Include Notice of Sale
NOTIFICATION OF PROSPECTIVE BIDDERS & LOCAL BANKS
COMPETITIVE BIDDING BY BOND UNDERWRITERS
BID SELECTED
RESOLUTION AWARDING SALE
BOND RESOLUTION
SALE OF BONDS BY UNDERWRITERS
BONDS PRINTED
BONDS REGISTERED & DELIVERED
Legal Opinion Prepared
Effective Upon Delivery

tire the debt before final maturity or refinance the project. The call feature of many revenue bonds may deter some investors.

3. SPECIAL ASSESSMENT BONDS

a. Purpose and Usage

Special assessment bonds are used to finance community improvements where the property benefitted by the improvements can be identified. Special assessment bonds may be issued to county or municipal government to defray the costs of capital improvement projects in rural improvement districts (RID) or special improvement districts (SID). Bonds may be issued to pay for all costs incurred through construction or maintenance activities within the special districts. (Reference: counties, 7-12-2169, MCA; municipalities 7-12-4201, MCA) Extensions of sewer or water systems are commonly financed through the issuance of special assessment bonds.

b. Issuing Procedures

The board of county commissioners or the city/town council may sell bonds to pay for the construction or operation and maintenance activities associated with special districts (RID or SID). The Notice of Sale, publication of notice, and the procedures for bond sale follow the same provisions as those for general obligation or revenue bond issues, but are subject to different time frames. A public referendum is not required to determine if special assessment bonds should be issued; however, landowners within the special district initially have the opportunity to decide whether or not the improvement should be undertaken, which ultimately determines if the bond will be issued. Debt financed by special assessment bonds is not subject to Montana limitations on bonded indebtedness.

Special assessment bonds may be sold to an underwriter on a competitive basis, soliciting bids to obtain the lowest borrowing costs. After all legal bond documentation is prepared, the board of county commissioners or the city/town council may sell the bonds. The bonds create a lien on only that property benefitting from the improvement. Bond payments are also backed by the creation of revolving funds. (Reference: RID,7-12-Part 21, MCA; SID, 7-12-Parts 41 and 42, MCA)

c. Advantages and Disadvantages

i) Advantages

The use of special assessment bonds to finance capital improvements is desirable because the burden of cost falls directly on the property owners benefitted by the improvements. Support of the local government's issuance of bonds is generally favorable, since a majority of landowners within the improvement district have expressed their approval of the project. Local government may view the use of special assessment bonds as being quite advantageous for several reasons. First, the debt financed by these bonds is not subject to Montana limitations on bonded indebtedness. Secondly, the bonds may be issued without a bond election, which is usually time consuming and costly to the public. Finally, the issuance of these bonds requires little or no capital from the issuing government. State statutes also allow local governments to invest surplus reserves in U.S. securities or in certificates of deposit which will hasten the retirement of district debts.

ii) Disadvantages

Two of the primary disadvantages associated with the issuance of special assessment bonds are directly related to the formation of improvement districts. Since the formation of an improvement district is seldom supported by all of the affected landowners, protesting landowners within the proposed improvement district may delay the project through procedures outlined in Montana statutes. If the protests result in a lengthy delay, increases in project costs may be significant enough to force cutbacks in or cancellation of the project. In addition, the assessment required of property owners within an RID or SID may unduly impact some individuals, especially in areas with a high percentage of low- or fixed-income residents. In the event that property owners fail to pay their assessments, local government may have to levy additional taxes to repay SID or RID revolving funds.

Since special assessment bonds are not backed by the full faith and credit of the issuing government, they represent a greater investment risk than bonds that have such backing. As a result, the bond market generally places a higher interest rate on these bonds than on other types. Administrative, legal and financial consultant costs may comprise a large percentage of the cost on some small improvement district projects. The flexibility of special assessment bonds is limited by Montana statutes regarding authorization, issuing procedures, and general bond provisions.

4. REFUNDING BONDS

a. Purpose and Usage

Refunding bonds are issued to retire an already outstanding bond issue. These bonds may be sold for cash and the outstanding bonds redeemed in cash, or the refunding bonds may be exchanged with the holders of the outstanding bonds. These bonds are generally issued to shorten the term of the outstanding bond issue, take advantage of a more favorable interest rate, eliminate restrictive covenants on the primary bond issue, reorganize the maturity schedule, or consolidate the community debt.

b. Issuing Procedures

In general, Montana counties or municipalities have the authority to issue refunding bonds for any purpose for which bonds were originally issued. Refunding bonds may be either general obligation or revenue bonds. Refunding general obligation bonds may be issued by Montana county or municipal governments, and are subject to the same statutory provisions governing the issuance of general obligation bonds, including limitations on bonded indebtedness (22.5% of the taxable valuation for counties; 28% of the taxable valuation for municipalities). A bond election is not required prior to the issuance of refunding general obligation bonds. The bonds must be issued with a maturity of not more than ten years or for the remaining term of the outstanding bond issue if the unexpired term exceeds ten years. The interest rate on these bonds must be at least 0.5 percent lower than that of the outstanding bonds. Normally, a refunding issue should not be considered unless the new interest rate would be one to two percent lower than the rate on the bonds to be refunded.

Issuance of refunding revenue bonds does not require voter approval and the debt incurred through the use of these bonds is not subject to state limitations on bonded indebtedness. Refunding revenue bonds may be issued after the governing body of a municipality passes a resolution stating its intention to issue the bonds. (References: County general obligation, 7-7-Part 23, MCA; municipal general obligation, 7-7-Part 43, MCA; municipal refunding revenue bonds, 7-7-Part 43, MCA)

c. Advantages and Disadvantages

i) Advantages

Refunding bonds provide local governments with an opportunity for flexibility in modifying the debt structure of the community. Use of refunding bonds is advantageous when substantial interest savings will occur by issuing a new lower yield bond to pay off a higher yield bond. Since no bond election is generally required, issuance costs to the local government are quite low. Municipal debt financed by refunding revenue bonds is not subject to Montana limitations on bonded indebtedness.

ii) Disadvantages

The savings realized by the issuance of refunding bonds must be significant enough to offset any accompanying administrative costs. In addition, Montana counties and municipal governments are subject to statutory provisions limiting indebtedness in the issuance of refunding general obligation bonds.

5. POOLING SMALLER LOCAL GOVERNMENT BONDS

a. Purpose

House Bill 733, which became law in July, 1983, authorizes the new Montana Economic Development Board to buy small security issues (limited to no more than $500,000 each) from Montana local governments. The term "securities" includes bonds, bond anticipation notes, or notes. The Board then "pools" individual securities into a larger package which is sold as a single issue to the private investment community. Because the pooled package will be of a larger dollar amount in comparison to smaller, individual local government issues and because the package will be marketed by the State of Montana, which has a more favorable bond rating than local governments, a lower interest rate should be realized.

b. General Information

Eligible participants are "local government units", which means any municipal corporation or political subdivision of the state, including without limitation any city, town, county, school district, or other special taxing district. Participation by an eligible local government unit in the pooling mechanism is entirely voluntary.

The financing mechanism will not change the local government procedures for issuance of bonds as specified by Montana law and described in this book. Instead of marketing the bonds themselves, local government units may sell their bonds or notes to the Board. The Board may place conditions on the local government prior to accepting an issue for pooling. Thus, a local government should contact the Board's Administrative Officer prior to developing a bond issue. Contacting the Board at the beginning of the process will avoid misunderstandings or delays.

The Board assembles several securities from individual Montana local governments and sells the package on the market. The individual local government receives a lower interest rate on its security (e.g., a water revenue bond). Essentially, the Board sets up a loan agreement with the local governments participating in the package issue and debt is retired via loan repayments to the Board. The Board may purchase bond anticipation notes from the local government to provide interim project financing. The Board may not make any loans to or purchase the bonds or notes of any single local government unit in an amount greater than $500,000 per single loan, bond issue, or note.

c. Implementation Schedule

Because the Economic Development Board is a new entity, administrative procedures and rules as to how the application process will operate have not yet been established. It is estimated that it will be at least February of 1984 before the Board will be able to consider purchase of local government securities. For further information, contact:

Administrative Officer
Montana Economic Development Board
Montana Department of Commerce
1424 Ninth Avenue
Helena, Montana 59620
Telephone: (406) 449-3494

6. SUMMARY OF BOND TYPES

The major features of the previously mentioned types of municipal bonds are summarized in Table 2. This summary table is intended to present a brief side-by-side comparison of the major bond types that municipal and county governments in Montana often issue to underwrite the costs of water and/or sewer facilities.

D. Other Long-Term Financing Methods

In addition to the long-term financing methods previously discussed in this chapter, several other methods may be effectively used to finance capital facilities. Methods discussed in the following narrative include: 1) industrial development revenue bonds; 2) capital improvements programming; and 3) lease-purchase agreements. The purpose of this section is to discuss the major features, usage, advantages and disadvantages of these alternatives. As communities become more and more fiscally conservative, the use of alternative methods of financing that reduce the long-term burden on local citizens has become increasingly important. These methods may have some limitations as financing sources for community water or sewer services, but may provide local governments with a means of setting portions of the costs associated with such systems.

1. INDUSTRIAL DEVELOPMENT BONDS

a. Purpose and Usage

Industrial development bonds, also known as industrial revenue bonds or industrial development revenue bonds, may be issued by a local government to aid industry in financing capital costs. These revenue bonds may be used to acquire or improve any land, building or

TABLE 2: SUMMARY OF MUNICIPAL BOND FEATURES

	DESCRIPTION	PURPOSE	LEGALITY	CITIZEN OR POLITICAL ACCEPTANCE	ADVANTAGES	DISADVANTAGES
GENERAL OBLIGATION BONDS	Bonds pledge the unlimited taxing power and the full faith and credit of issuing government to meet the required principal and interest payments The amount of general obligation debt that a community can issue is limited by state law Interest rates on these bonds are typically lower than for other bond types.	General Obligation Bonds are most often used by local governments to finance capital projects which benefit the entire community and whose cost should be defrayed over a long period of time.	Authority to Issue Bonds Municipalities 7-7-4201, MCA Counties 7-7-2202, MCA City-County 7-7-107, MCA Issuing Procedures — Sewer and Water Systems Municipalities 7-7-Part 42 7-13-Part 43 Counties 7-7-Part 22 7-13-Part 23 Bond Limits: Municipalities 28% of taxable value and additional 55% of taxable value for water/sewer (7-7-4201 and 4202, MCA) Counties 11.25% of taxable value for most purposes (7-7-2203, MCA) City-County 39% of taxable value and additional 10% of taxable value for water/sewer systems (7-7-107 and 108, MCA)	Montana law (7-7-Parts 1, 42 and 7-7-223, MCA) require a bond election to allow citizens the right to approve or reject each issue. Procedures also exist to protest municipal bond elections (7-7-105, 106, MCA)	• Interest rates are frequently lower than for other bond types • General Obligation Bonds possess more marketability due to the secure nature of the investment • Non-revenue producing projects may be financed through the use of these bonds • Debt can be retired over the life of the project from an equitable form of taxation • The community has the opportunity to invest the proceeds of the bond issue	• Voter approval is required to issue general obligation debt • Bonds are subject to statutory limitations on amount of public indebtedness • The time lag required by bonding procedures may increase construction costs • A default on a bond issue may require the local government to raise taxes • A complex credit analysis is required to market bonds • If property taxes are used to pay off the debt, the project is being paid for by all property owners, instead of just those directly benefitted by the project
REVENUE BONDS	Bonds pledge the revenue from a particular revenue source (generally receipts from the facility to be constructed) to meet principal and interest payments. Bonds are issued without the full faith and credit of the issuing agency.	Revenue Bonds are used by local governments to provide initial financing of facilities or capital improvements that could be self-supporting from revenues generated over the life of the system.	Authority to Issue Bonds Municipalities 7-7-4421, MCA 7-7-4321 and 4322, MCA Counties 7-7-Part 44 and 7-7-Part 45, MCA Issuing Procedures: Municipalities 7-7-Parts 44 and 45, MCA 7-13-Part 43, MCA Counties Subject to same basic provisions as those for cities and towns	Since the use of revenue bonds is applied to self-supporting facilities, only persons directly benefitting from the services provided by the facility must bear the costs. Citizen concern is most often directed at the rates established to pay for the facility. In Montana, rate structures for water/sewer services are typically subject to approval by the Public Service Commission.	• Users pay for the facility • Debt is not subject to Montana limitations on bonded indebtedness • Voter approval is not required • Default on the issue does not burden local taxpayers, but may increase utility rates • The credit analysis required is straightforward • The use of revenue bonds promotes sound financial management and allows the community to create operation, maintenance, and reserve funds.	• The use of revenue bonds is limited to projects that will be self-supporting • The legal requirements for issuing revenue bonds are much more complicated than those for general obligation bonds
SPECIAL ASSESSMENT BONDS	Bonds are issued to pay for public improvements in which the property benefitted can be identified. Principal and interest payments are made by a special assessment on the property benefitting from the improvements.	Special Assessment Bonds allow property owners the opportunity to amortize the capital costs of constructing the particular public facility over a number of years at a relatively low interest rate.	General Procedures: Municipalities SIDs. 7-12-Parts 41 and 42, MCA Counties RIDs: 7-12-21, MCA Improvement District Bonding Requirements Municipalities SIDs: 7-12-Part 42, MCA Counties RIDs 7-12-2169, MCA	The burden of paying for a desired public improvement falls directly on the benefitted property owners Special assessment districts are formed on the basis of the petition of a majority of property owners Some opposition may occur from impacted landowners who do not favor the creation of the special district	• The burden of the costs falls directly on the benefitted property owners • A bond election is not required • Little or no capital is required from the issuing agency • Public support is generally enhanced through involvement of the affected property owners • Local governments may invest the proceeds of the bond issue for the benefit at the district • Debt financed by special assessment bonds is not subject to debt limitations	• The project may be delayed due to protests by some impacted property owners • Administrative costs may compromise a large percentage of small project costs • Special assessments may unduly impact landowners in low-income areas • In the event that property owners fail to make the required payment, local government may have to levy additional taxes to repay the revolving fund
REFUNDING BONDS	Bonds are issued to retire an already outstanding bond These refunding bonds may be sold for cash and the outstanding bonds redeemed in cash, or the refunding bonds may be exchanged with the holders of the outstanding bonds. These bonds may be general obligation or revenue bonds.	Refunding Bonds are generally issued to shorten the term of the bond issue, to take advantage of more favorable interest rates, to eliminate restrictive covenants affecting the primary issue, to reorganize the maturity schedule, or to consolidate a community's debt	Authority to Issue Refunding Bonds: Municipalities (G.O 7-7-4301, MCA) (Revenue. 7-7-4501, MCA) Counties (G.O.. 7-7-2301, MCA) Procedures and Requirements Municipalities (G.O. 7-7-Part 43, MCA) (Revenue 7-7-Parts 45 and 46, MCA) Counties (G.O.: 7-7-Part 23, MCA)	Citizen understanding and a clear statement of the purpose for issue those bonds is necessary for acceptance by the public	• Refunding bonds offer the opportunity for flexibility in modifying the debt structure of the community • Debt financed by certain refunding bonds may not be subject to debt limitations • No bond election is required • Generally, any bond that can be legally issued can be legally refunded • The issuing agency will save interest expenses by issuing new lower yield bonds to pay off higher yield bonds	• Cost savings must be significant enough to offset the accompanying administrative costs

other facility necessary to stimulate economic growth, attract industry, or provide services to protect the public health or welfare. Projects authorized to be funded by the issuance of industrial development bonds are identified in Montana statutes (90-5-101, MCA). The use of industrial development bonds within Montana has primarily been associated with commercial development. A portion of the proceeds from the sale of these bonds has typically been used to offset the cost of extending water or sewer services to the new commercial facilities. Income generated by the industrial or commercial facilities is used to repay the principal and interest on the bond issue. In case of a default, the bonds are secured through mortgages covering land and buildings or other encumbrances on property, such as equipment.

b. Issuing Procedures

Provisions for the issuance of industrial development bonds by municipal or county governments in Montana are specified in State statutes (90-5-102 through 90-5-110, MCA). Prior to issuing any bonds, local governments must hold a hearing on the proposed project to solicit comments from the public. Notice of the hearing must be published in a local newspaper for three weeks and must specify the time, date and place of the hearing; the nature of the project; the name of the user of the funds; and the estimated cost of the project. After public comments have been reviewed, the local government may not issue bonds unless the proposed project is in the public interest. Any bond provisions deemed to be in the public interest may be acceptable to the local government; however, the final maturity of the bond cannot exceed 30 years from the original date of issue. Industrial development bonds may be underwritten and marketed in the same manner as revenue bonds and are done so by negotiated sale.

c. Advantages and Disadvantages

i) Advantages

One of the major advantages associated with the issuance of industrial development bonds is that debt incurred through this financing method is not a liability to the community. The debt is retired by the industrial or commercial operations that used the bonds for financing. In addition, debt financed through the use of these bonds is not subject to Montana limitations on bonded indebtedness. The use of these bonds also allows the local community to exercise some control over its economic future. Since a hearing on the proposed project is required before any bonds can be issued, the local government depends on its citizens to help determine the community's future. Industrial development bonds may allow industrial or commercial growth to occur in areas where private financing would not allow such expansion. As a result, economic growth may occur at a desirable rate in a community which

TABLE 2: SUMMARY OF

	DESCRIPTION	DISADVANTAGES
GENERAL OBLIGATION BONDS	Bonds pledge the unlimited taxing power and the full faith and credit of issuing government to meet the required principal and interest payments. The amount of general obligation debt that a community can issue is limited by state law. Interest rates on these bonds are typically lower than for other bond types.	• Voter approval is required to issue general obligation debt • Bonds are subject to statutory limitations on amount of public indebtedness • The time lag required by bonding procedures may increase construction costs • A default on a bond issue may require the local government to raise taxes • A complex credit analysis is required to market bonds • If property taxes are used to pay off the debt, the project is being paid for by all property owners, instead of just those directly benefitted by the project
REVENUE BONDS	Bonds pledge the revenue from a particular revenue source (generally receipts from the facility to be constructed) to meet principal and interest payments. Bonds are issued without the full faith and credit of the issuing agency.	• The use of revenue bonds is limited to projects that will be self-supporting • The legal requirements for issuing revenue bonds are much more complicated than those for general obligation bonds
SPECIAL ASSESSMENT BONDS	Bonds are issued to pay for public improvements in which the property benefitted can be identified. Principal and Interest payments are made by a special assessment on the property benefitting from the improvements.	• The project may be delayed due to protests by some impacted property owners • Administrative costs may compromise a large percentage of small project costs • Special assessments may unduly impact landowners in low-income areas • In the event that property owners fail to make the required payment, local government may have to levy additional taxes to repay the revolving fund
REFUNDING BONDS	Bonds are issued to retire an already outstanding bond. These refunding bonds may be sold for cash and the outstanding bonds redeemed in cash, or the refunding bonds may be exchanged with the holders of the outstanding bonds. These bonds may be general obligation or revenue bonds.	• Cost savings must be significant enough to offset the accompanying administrative costs

other facility necessary to stimulate economic growth, attract industry, or provide services to protect the public health or welfare. Projects authorized to be funded by the issuance of industrial development bonds are identified in Montana statutes (90-5-101, MCA). The use of industrial development bonds within Montana has primarily been associated with commercial development. A portion of the proceeds from the sale of these bonds has typically been used to offset the cost of extending water or sewer services to the new commercial facilities. Income generated by the industrial or commercial facilities is used to repay the principal and interest on the bond issue. In case of a default, the bonds are secured through mortgages covering land and buildings or other encumbrances on property, such as equipment.

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ii) Disadvantages

One of the primary problems associated with the use of industrial development bonds is that citizen acceptance of such bonds may be difficult to obtain. Citizens often express the concern that the issuance of such bonds represents a public subsidy of private industry. Montana statutes impose limitations on the types of projects that may utilize the proceeds of the bond sale and identify acceptable project cost items. Since the community is not responsible for debt retirement, interest rates associated with industrial development bonds are generally the highest of all tax-exempt bonds. Unless an industrial or commercial enterprise has a good record of debt retirement and a financial structure to service the debt, the bond issue will most likely be difficult to underwrite and market. The local governing body can only use this financing technique in conjunction with private enterprise development; it does not initiate the project.

2. CAPITAL IMPROVEMENTS PROGRAMMING AND BUDGETING

a. Purpose and Usage

Capital improvements programming is the preparation and updating of a proposed schedule or public facilities or equipment to be constructed or purchased by a local government over a period of time in the future (usually five or six years). The monies to pay for desired capital improvement projects are generated by the capital improvements fund. Montana statutes allow counties to derive this fund from multiple levies; however, no more than ten percent of the money derived from any one levy may be appropriated to the fund. Municipalities utilizing an all-purpose levy may earmark up to five percent of the levy to pay for capital improvements. These funds are available to local government only if the governing body has adopted a capital improvements program. This program is implemented through the preparation of the capital improvements budget, a detailed list of specific capital improvement projects outlining expenditures and revenues, which is adopted by the governing body as part of the annual budget.

b. Capital Improvements Programming Process

The capital improvements programming process is an organized and sophisticated method of planning and executing large expenditures by local government. The program allows local officials to make objective and informed decisions as to how their community will provide for its citizens by guaranteeing the most effective use of limited resources. The major steps in the process include:

- Identification of proposed capital improvements: Each department of local government is responsible for identifying the need, costs, possible financing sources, and a desired time table for the proposed project.

- Preparation of a community financial analysis: This analysis examines the community's ability to pay for the desired improvements. Current and future revenues and expenditures, tax burdens, bonding capacity, and the effects of alternate financing methods may be detailed in this analysis.

- Prioritization of proposed projects: This step involves the evaluation and ranking of all proposed capital improvements projects. Factors used to set project priorities may include the project's relationship to community goals and planning efforts, the project's relationship to other projects, available financial assistance, and cost effectiveness. Public participation is also highly desirable in setting project priorities.

- Preparation of a final capital improvements program: After priorities have been established, the final program is prepared outlining projects, estimated completion schedules, and methods of financing each project.

- Adoption of the capital improvements program: Following adoption of the capital improvements program, the governing body may wish to adopt the first year of the program (capital budget) as a portion of their annual budget. This capital budget will appropriate funds for the first year of the program and commit local government to provide the revenue from the sources legally available to municipal or county governments.

- Annual review and update of program: Capital improvements programs must be flexible enough to change as the community's priorities change. The annual review also allows the progress and performance of the program to be monitored. Annual review and revision of the capital improvements program insures that the process will become a continuing part of the local government's budgeting procedures.

A capital improvements program does not need to be complex, and may be tailored to fit the individual needs of a community. The program is a plan, and does not commit local government to spending funds unless the capital budget is adopted as a portion of the annual budget.

c. Benefits of Capital Improvements Program

Capital improvements programs enable local governments to collect useful information regarding the condition of community facilities to allow for the orderly repair and replacement of capital facilities and equipment years ahead of the actual need. Advance planning and scheduling of these projects allows communities to avoid costly mistakes and make the best use of generally limited financial resources. A capital improvements program is also a valuable financial tool, since analysis of the financial status of the community allows local government to establish and maintain a level of spending that it can safely afford. In addition, the capital improvements programming process is an important step in securing federal or state assistance for proposed capital projects. Since most federal or state assistance programs require some sort of facilities planning, communities that have adopted a capital improvements program may be in a favorable position to receive such funding. This type of planning activity is also beneficial in obtaining a good community credit rating, which is necessary to market municipal bond issues.

3. LEASING

a. Purpose and Usage

Leasing is a financing method that local governments may use to obtain capital facilities without issuing municipal bonds. Two forms of leasing most often used by local governments are the traditional operating lease and the lease-purchase agreement. Traditional operating leases are often used to acquire the use of relatively small capital items without a direct purchase. Lease-purchase agreements are used by units of local government to acquire any property or equipment that a supplier is willing to sell on an installment basis. These agreements allow local government to lease the facilities from a private firm; after a specified period of time, the government acquires full ownership of the facility. If the lease agreement requires purchase of the facility, the cost comprises a share of the government's indebtedness.

b. Advantages and Disadvantages

i) Advantages

The primary advantage offered to local government through the use of lease agreements is that impacts on community debt limitations may be avoided if the lease agreement is properly structured. In addition, the costs of entering into the lease agreement may be less than those incurred if municipal bonds are issued. Acquisition of capital facilities may occur faster through leasing than with the use of debt financing.

ii) Disadvantages

Although this financing method is commonly used to acquire capital facilities and equipment, use of leasing is limited in regard to water or sewer facilities. This method may be used for some components of such systems (e.g., monitoring equipment), but other financing methods which defray costs over a longer period than lease agreements are most often used. Lease financing requires that annual or semi-annual lease payments be budgeted from current revenues. Other long-term financing methods allow debt to be retired from revenue produced by the facility itself.

E. Short-Term or Interim Financing

1. GENERAL

Short-term or interim financing is often used by local governments to even out cash flows, to take advantage of lower interest costs, and to provide initial construction financing. This financing method allows governments to meet operating expenditures or financial commitments when revenue is not "in hand" but is anticipated. Short-term borrowing is most often used by local governments to avoid making a long-term commitment at high rates of interest. This short-term debt may be turned into a long-term obligation once conditions in the municipal bond market improve. This use of short-term financing allows project construction to begin as scheduled, even though interest rates for long-term obligations may be unduly high. Use of short-term financing methods can be of great benefit to local government; however, care must be taken to insure that short-term debts do not become additional long-term commitments. The following narrative briefly identifies several forms of short-term or interim financing available to local governments.

2. METHODS OF SHORT-TERM FINANCING

a. Reserve Funds

The establishment of reserve funds for capital improvements is a financing method which allows local governments to pay for improvements in cash instead of borrowing against future revenues. Reserve funds for future expenditures can be accumulated by annual increments or by setting aside unanticipated income until the balance of the account is large enough to undertake the capital improvement. Typical sources of reserve funds include earmarked operational revenues, depreciation accounts or proceeds from the sale of capital assets such as property. Reserve funds constitute a sound method of financing since local governments are not required to incur indebtedness for the proposed improvement; however, the funds required to undertake necessary capital improvements may take a long time to accumulate. If the reserve fund is insufficient to pay for a needed improvement, alternate forms of financing, most often debt financing, must be used to supplement the fund. The use of reserve funds may be advantageous to small communities where large capital improvements do not occur often. One drawback to the use of this method is that unless interest from the investment of the reserve fund is well managed, any gains in revenue may be offset by losses to inflation.

b. Warrants

A warrant is an order drawn by a government unit directing the treasurer of the issuing government to pay a specified amount to the person named or the bearer. This traditional short-term security is often directly placed with a bank. In the municipal bond market, warrants may be attached to bonds and allow investors to purchase future bonds at the same price and interest rate as the original bond issue during a specific period.

c. Government Notes

Bond anticipation notes provide a means of financing in anticipation of a future bond issue. These notes are traditionally issued as a bridge between the start of a project and eventual long-term financing through the issuance of municipal bonds.

The least secure of all the notes issued by local governments are bond anticipation notes. Their security is dependent upon the local government's ability to issue the bonds keyed to the notes. Use of bond anticipation notes in lieu of long-term bonds is primarily done to take advantage of lower interest rates. The issuer hopes to gain access to the market at lower long-term rates when the notes mature (generally in one to three years). Initial use of bond anticipation notes may ultimately reduce total project costs.

d. Federal Revenue Sharing

Federal revenue sharing funds comprise a possible source of interim financing for local governments. These funds may be used by a local government for any purpose for which its own funds may be legally budgeted and expended. Funds are allocated to the state and local governments based on a formula that considers the population, per capita income, and local tax efforts. Within each state, State government receives one-third of the allocation and local governments (tribal, county and municipal) receive the remaining two-thirds. Any person, group or agency may seek revenue sharing funds from state or local government and must be allowed to participate in two public hearings. The governing body is required to hold hearings to obtain public input about the possible use of funds and to review proposed budgets after the use of funds has been determined. These funds may be used as the matching share of federal grant programs, and must be spent within two years of the end of the entitlement period.

Entitlements to Montana counties, cities, towns and tribal governments for fiscal year 1983 total $19,261,536, which includes $12,103,208 for county governments, $6,158,156 for city and town governments, and $1,008,172 for tribal governments. These entitlements range from $20,855 to $1,067,722 for Montana counties, and from $2,376 to $1,007,350 for Montana cities and towns.

e. County Land Planning Funds

Montana statutes require that one-half of one percent of the coal severance tax be placed in an earmarked account to be used solely for county land planning purposes. These funds are administered by the Department of Commerce and allotted to counties according to a formula that gives $3,000 per year to each county and distributes the remainder of the funds based on a county's proportions of total state population and land area. If a multi-jurisdictional planning board has been established in the county, this board may expend all or part of the funds allocated to the county. The total county land planning fund is projected to be $493,270 for fiscal year 1984 and should reach $615,335 by fiscal year 1985. In the past, individual county allotments have ranged from $3,600 to nearly $20,000.

Counties have used these planning funds to pay salaries of full- or part-time staff, hire private consultants, or purchase materials and equipment. Typical products of these funds as they relate to community water and sewer systems include:

- Water and sewer studies (e.g., inflow/infiltration studies);
- Feasibility studies for system improvement or expansion;
- Capital improvement programs;
- Comprehensive plans;
- Physical inventories;
- Community facilities plans; and
- County mapping (e.g., preparation of water and/or sewer system maps).

At the end of each fiscal year, county government and the planning agency receiving these planning funds must submit documentation of how the money was spent. Surplus funds are placed in the educational trust fund account.

f. DNRC Grant and Loan Programs

Interim funding in the form of construction loans is available from the Department of Natural Resources and Conservation in conjunction with projects already being funded through the Water Development or

Renewable Resource Development Programs. DNRC will advance funds to cover costs as the recipients incur expenses.

F. Local Revenue Sources

1. GENERAL

Since financial assistance in the form of federal or state grants rarely underwrites the total cost of new construction or improvements to existing water or sewer facilities, local governments most often issue some form of bonds to pay for the remaining share of the costs. Repayment of this debt is the responsibility of the community, except in the case of special districts where property owners benefitted by the project must retire the debt. The principal methods of debt retirement are through additional taxation and the assessment of charges for the services provided by the community. The following narrative identifies the sources of local revenue that are available for repayment of debt incurred for water and/or sewer projects. In addition, this section contains a discussion of the general usage of these methods, a summary of procedural requirements for each method, and a discussion of the advantages and disadvantages inherent to each method.

2. USER CHARGES

a. General

Inflation, high labor costs, and the growing citizen demand to check tax increases have reduced the revenue available to local governments and made it increasingly difficult for local officials to provide the same levels of service that they have in the past. Local governments are faced with three alternatives to remedy the problem, including increasing revenues, reducing the quality and quantity of services, or finding means to cut the cost of services. Local governments obviously prefer the last option. In view of the fact that resistance to increases in local property taxes is growing, it is obvious that communities must meet their needs from sources of revenue other than property taxes. User charges present local governments with a source of revenue that is equitable and generally accepted by the community.

User charges can be defined as the amount of revenue that a local government may receive from the public from the performance of specific services benefitting individuals or commercial or industrial concerns within the community. User charges place the burden of paying for certain services on the individual benefitting from the service. This is in contrast to taxation, which may not be directly related to the value of a specific service received by an individual. User charges are not a cure-all for the financial problems faced by local governments; however, a system which equitably and directly places the cost of providing certain services upon the persons benefitting from them may be a more acceptable option to local governments and citizens than a tax increase.

b. Applicability of User Charges

User charges are an appropriate means of financing community services whenever the direct benefit that an individual, commercial or industrial enterprise receives can be determined. It is appropriate to impose user fees whenever government provides a service to an individual, firm or group that it does not provide to the general public. If user charges are not received from special services provided to select groups, the recipients of the service are subsidized by local taxpayers.

User charges are inappropriate when non-payers cannot be excluded from the benefits of receiving community services. If non-paying users are allowed to receive community services, those paying for the service will soon realize that they may also receive the service at no charge. If this situation occurs, the revenue necessary to provide the community service may eventually disappear. If a program provides community-wide benefits, the local government may forego a user charge system and subsidize the service.

c. Advantages and Disadvantages

i) Advantages

The implementation of user charges for selected community services offers several advantages to the community. If properly assessed, user charges can provide alternate sources of revenue, prevent waste and unwarranted expansion of services, and distribute services in an equitable fashion. Since attempts to increase property taxes are often limited by statutes or citizen disapproval, local governments have begun to diversify their revenue sources to become less dependent on property taxes as a revenue source. User charges provide a form of revenue that is more acceptable to the general public because user charges directly connect the cost of providing a particular service with the benefits received from the service. Citizens may therefore be more tolerant of future increases in user charges than they would be of tax increases.

User charges may also inhibit waste and prevent unwarranted expansion of community services. Under a user charge system, government managers must search for efficient methods to conduct their operations because their budgets may consist only of revenues collected by user charges. Such charges also provide governments with information from consumers about the kind, quality and quantity of service that should be provided. As a result, the willingness of people to pay for the service is an important indicator of whether or not the service should be continued. Under a user fee system, any expansion of community services is matched by an increase in revenue from new users.

User charges also distribute services on an equitable basis within the community. A direct user charge may be more acceptable to low- or fixed-income residents since they have the option of not using a service and thereby avoiding the charge instead of paying for services they do not want or cannot afford. However, this situation is not applicable to water and sewer services since the need for the community service may be mandated by federal and state regulations.

ii) Disadvantages

User charge systems do not provide for payment by undeveloped property or for the benefit of having capacity built into the community service, whether or not it is used. Local government must absorb or pass along the cost of any additional capacity requirements to consumers in the form of higher user fees. In addition, the user charge system does not permit a distribution of charges according to the general community benefit that results from having services that protect the public health, eliminate nuisances, or enhance the overall community living environment.

d. Sewer and Water System User Charges

One of the most common applications of user charges is as a revenue source to offset the costs of community sewer or water service. Wastewater user charges provide financial support of community wastewater systems and treatment facilities based on a method that reflects the actual physical use of the system, such as:

- Volume of wastewater;
- Volume of wastewater and quantity of pollutants (industrial uses)
- Number or size of sewer connections;
- Type and usage of property;
- Number and type of plumbing fixtures in rooms; or
- Household size.

The basis of the user fee is that the particular base selected by the community is a fair method of distributing costs according to the use made of the system. This system permits fair charges to churches, schools, organizations or other governmental units that are not required to pay property taxes. The wastewater user charge system constitutes a very stable source of operating funds for the system. This stability allows communities to plan for the future and upgrade or expand facilities when necessary.

User charges for the provision of community water systems are most often based on the metered usage of water, which provides the most practical means of determining consumer water use. If water use is not metered, a uniform charge or flat rate may be made to each house or building connected to the system, or a fixed charge may be assessed to each class of customer (i.e., residential, commercial, or industrial users). This system is simple and easy to administer; however, the flat rate system does not reflect the extent of use.

Since most of the water supplied by community water systems will ultimately pass through the community's wastewater system, water records may be used to establish wastewater user charges. Typically, water use is closely monitored during the non-irrigation season, and it is assumed that water consumption during this period will be the same as the total wastewater flow. Average household rates for water consumption and sewer system user charges can then be calculated on the basis of this "base" period to offset the operating expenses of wastewater facilities. Rates during the remainder of the year are determined by the amount of water used above or below the average household rate. Rates for commercial or industrial concerns may be determined by equating water consumption to equivalent household units. For example, a laundromat may generate ten times the amount of wastewater that an individual household does; thus, the wastewater system charge would be equivalent to ten household units. If a community does not have a metered water supply, standards are available that will allow local governments to levy appropriate wastewater charges. Various publications covering these matters are available through the Montana Water Quality Bureau or the Environmental Protection Agency's office in Helena.

e. Connection and Plant Investment Fees

Financing plans of water and sewer projects may include a one-time initial charge to the user for connection into the municipal system. This fee, payable at the time the connection to the system is made, may comprise one of the principal sources of municipal wastewater revenues. These fees are usually assessed to compensate the governing entity for one or more of the following: 1) costs for the local authorized officials to inspect the installation of the connection; 2) any materials and installation costs associated with the actual service connection that are not paid for directly by the land owner including pipe, meters, asphalt removal and replacement, etc.; and 3) facility investment fees which include the replacement value assessed to a new development for its proportionate share of the existing collection, distribution and/or treatment facilities that the development will subsequently be using. Since these type of fees are usually flat rates, the charge is not responsive to inflation; however, automatic adjustments in these fees may be established to compensate for inflation. The establishment, collection and disbursement of these fees is the responsibility of the system manager, whether that is the local government or a special authority.

3. IMPROVEMENT DISTRICTS

a. General

An improvement district is a legal mechanism through which the costs of public improvements are allocated by special assessment taxes on properties benefitting by the improvement. Improvement districts are generally formed by local governments or through the initiative of property owners to deliver a desirable community service or improvement to an area where such services or improvements are presently lacking. These districts allow the construction and financing of the improvement quickly through the sale of special assessment bonds, while repayment of the project costs occurs over a long period of time through assessments on property within the improvement district. Since the municipal bonds sold to finance improvement districts are tax-exempt, costs to property owners are generally less than with private financing.

The following narrative identifies and discusses the two types of improvement districts commonly formed to provide or extend water and/ or sewer services to urban or rural portions of communities.

b. Special Improvement Districts (SID)

i) Authorization

Municipal governments in Montana have the power to create Special Improvement Districts and order the construction or reconstruction of sewer or water works within the District whenever the governing body judges that the project is in the public interest or convenience. The governing body has the power to levy and collect property assessments within a designated Special Improvement District. Landowners may also petition local government to create an SID. These districts may include properties abutting the community if 60 percent of the property owners in the district approve, and a joint resolution by county and municipal government is passed.

ii) Procedural Requirements

The formation of a Special Improvement District is subject to the procedural requirements established in Montana statutes (Title 7, Chapter 12, Parts 41 and 42). These statutes outline the legal requirements concerning SID formation, public involvement, bid procedures, special assessment bonding, and SID implementation. Table 3 outlines the major requirements and corresponding government actions necessary to legally form an SID in Montana. References to legal provisions contained in Montana Code Annotated have been included for further research.

TABLE 3

FORMATION AND OPERATION OF SPECIAL IMPROVEMENT DISTRICTS

REQUIREMENTS	REQUIRED GOVT. ACTION
1. Resolution of Intention to Create an SID * Notice that city/town intends to propose SID * Delineate SID boundaries * Decide on type and extent of improvements * Determine approximate cost * Identify SID by number * State whether or not an extended SID is created Reference: 7-12-4102 through 7-12-4104, MCA	Resolution of Intent to Create an SID must be passed by Council * Local government may order the creation of an SID whenever the district serves the public interest or convenience * Local residents may request the governing body to form an SID by petition of all property owners in the proposed district
2. Public Notification * Describe general character of improvements * Supply cost estimate for proposal * Designate time and place where Council may hear protests against SID formation * Make reference to Resolution of Intent as source of specific SID information Reference: 7-12-4105 through 7-12-4108, MCA	Notify Public by Newspaper • * Must be published for five days in daily newspaper or in one issue of weekly newspaper * If no newspaper is published in the community, notice must be posted in three public places for five days * Affidavit of publication is required Notify Public by Mail • * Mail notification to every person, firm, and corporation having property within the district on the same day notification is first published or posted • If petition to form SID is signed by all property owners in the proposed district, local governments may adopt a Resolution of Intention without publication or posting of the Resolution

TABLE 3
(cont.)

REQUIREMENTS	REQUIRED GOVT. ACTION
3. Protest Hearing	
* Written protest must be filed by affected property owners within 15 days of the first publication of Notice (7-12-4110, MCA)	* City/Town Clerk must endorse the protest with the date and time of filing
* Affected property owners may protest in person at the public hearing (7-12-4112, MCA)	* Council/Commission shall hear protests and decide on questions at the next scheduled meeting after the 15-day protest period ends * If no protests are filed or if protests are judged insufficient, the Council/Commission may draft a resolution creating the SID
* To block the formation of the district, a protest must be signed by more than 50 percent of the affected property owners (7-12-4113, MCA)	* If a protest signed by more than 50 percent of the property owners is received, the issue shall be tabled for six months * In the case of the construction of sanitary sewer improvements, a majority vote of the Council/Commission may overrule a protest unless it is made by more than 75 percent of the affected landowners
4. Creation of SID	
* Draft resolution creating SID (including allocation of assessments and purpose) (7-12-4114 and 7-12-4115, MCA)	* Council/Commission must adopt Resolution to Create SID in accordance with Resolution of Intention

TABLE 3
(cont.)

REQUIREMENTS	REQUIRED GOVT. ACTION
* Publish notice calling for bids on the work. In this notice, set time of bid opening at least ten days from last publication of the notice; state that bid security must accompany the bid; and state that bids must be delivered to the Clerk (7-12-4141, MCA)	* Notice must be published at least twice in daily, semi-weekly or weekly community newspaper * If no paper is published in the community, notice must be posted in a public place
* Evaluate bids (7-12-4142, MCA)	* Council/Commission must open and read bids in public session * Local government may reject the bids and readvertise if in the public interest
* Award contract to the low bidder (7-12-4143 and 7-12-4145, MCA)	* Council/Commission awards bid to lowest responsible bidder * Bid security is held until the contract is signed * Council/Commission must re-advertise if contractor does not sign contract within 15 days of notice of award (7-12-4149, MCA)
* If all bids are rejected or no bids are received (7-12-4144, MCA)	* Council/Commission may re-advertise any time within two years
5. SID Implementation	
* Assessment of Costs Area Option Frontage Option Combined Option (7-12-4161 through 7-12-4163, MCA)	* Council/Commission shall adopt the desired method of assessment (7-12-4179, MCA) * Council/Commission must pass a resolution to levy and assess tax on district property (7-12-4176 through 7-12-4178, MCA)

TABLE 3
(cont.)

REQUIREMENTS	REQUIRED GOVT. ACTION
* Collection of Assessments (7-12-4181, MCA)	* Council/Commission must assign responsibility for assessment collection to County Treasurer, City Treasurer, or Town Clerk * Revenue collected from assessments shall be placed in SID fund (7-12-4180, MCA)
* Use of Bonds and Warrants (7-12-4203 through 7-12-4247, MCA)	* Council/Commission shall sell bonds or issue warrants to pay for improvements within district according to legal bonding procedures * Council/Commission may establish SID revolving fund by ordinance to secure prompt payment of bonds and warrants * Recent legislation allows local governments to issue SID bonds without revolving fund backing. Government may by resolution provide that bonds and warrants be payable solely from SID fund and have no claim against revolving fund

iii) Financing Options for SIDs

The primary source of financing for SID water or sewer projects is the property owners within the district. Municipal governments are empowered to issue special assessment bonds to pay for the improvements within the district, and property owners within the district are assessed to repay the bond issue. In Montana, the assessments to property owners may be based on several methods, including total parcel or lot area, lineal feet of frontage abutting city streets, or a combination of total area and frontage.

Federal and state funds may also be available for some SID water or sewer projects. Community Development Block Grants, Coal Board Discretionary Grants and FmHA Water and Waste Disposal Loans and Grants may be used for such projects, provided application procedures and eligibility requirements are met. Community Development Block Grants are administered by the Montana Department of Commerce and may be used for the payment of special assessments levied against properties owned and/or occupied by "low and moderate income persons". Coal Board grants for sewer and water projects in SIDs are available to counties and municipalities designated as coal development impact areas and to the remainder of Montana communities and counties at the discretion of the Coal Board. Farmers Home Administration funding may also be utilized by special districts to finance portions of the construction cost of necessary sewer or water services.

c. Rural Improvement Districts (RID)

i) Authorization

The Board of County Commissioners is empowered to order and create Rural Improvement Districts whenever the formation of such a district is in the public interest or convenience. Provisions are also included in Montana statutes to allow these districts to be formed at the request of 60 percent of the property owners in a proposed RID. In addition to properties within a county, these districts may include properties abutting or within a community, provided that landowners in the proposed district approve and a resolution is adopted by both county and municipal governments. These districts are commonly created to extend community water and sewer services into developing areas adjacent to cities.

ii) Procedural Requirements

The procedural requirements for the formation of Rural Improvement Districts are established by Montana statutes (Title 7, Chapter 12, Part 21). These statutes detail all legal requirements relating to such districts and specify procedures for formation, public involvement and protest, bid solicitation and award, special assessment bonding, and operation and maintenance of the district. Table 4 summarizes the major

TABLE 4

FORMATION AND OPERATION OF RURAL IMPROVEMENT DISTRICTS

REQUIREMENTS	REQUIRED GOVT. ACTION
1. Resolution of Intention	
* Designate number of district * Describe boundaries of district * Decide type and extent of improvements * Estimate approximate cost of improvements * Designate name of engineer in charge	* County Commissioners must pass Resolution of Intention
Reference: 7-12-2102 and 7-12-2103, MCA	
2. Public Notice	
* Describe character of improvements * Estimate costs of improvements * Establish time and place where Commissioners will hear protests * Include reference to Resolution of Intention for district boundaries description	Notify Public by Newspaper * Publish for ten consecutive days in a daily newspaper or two issues of weekly newspaper published closest to the place where the RID is to be created * Notice must be posted in three public places within the proposed district * Affidavit of publication is required Notify Public by Mail * Mail notification to every person, firm, or corporation having property in the district on the same day that notification is first published or posted
Reference: 7-12-2104 through 7-12-2107, MCA	

TABLE 4
(cont.)

REQUIREMENTS	REQUIRED GOVT. ACTION
3. Protest Hearing	
* Written protests may be filed by affected property owners within 15 days of first publication of notice of passage of Resolution of Intention (7-12-2109, MCA)	* County Clerk must endorse the protest with date filed
* Affected property owners may protest in person at the hearing (7-12-2111, MCA)	* At next regular meeting of the County Commissioners after the protest period ends, Commissioners shall hear protests and make a decision on the RID * If no protests are filed or if protests are judged insufficient, Commissioners will have immediately acquired jurisdiction over improvements and may draft a resolution creating the RID
* A protest may be filed that is signed by more than 50 percent of the affected property owners (7-12-2112, MCA)	* The issue shall be tabled for six months * In the case of sanitary sewer improvements, protests may be overruled by unanimous vote of Board of County Commissioners
4. Creation of RID	
* Draft resolution creating RID (7-12-2113, MCA)	* County Commissioners must pass resolution to create RID in accordance with Resolution of Intention
* Publish Notice calling for Bids on the Work * Set time of bid opening not less than 15 days from the last publication of notice * State that bids must be accompanied by bid security * Deliver bids to County Clerk (7-12-2131 through 7-12-2133, MCA)	* Publish at least twice in a daily, weekly, or semi-weekly newspaper published and circulated closest to the boundaries of the RID * Post a copy of the notice in three public places

TABLE 4
(cont.)

REQUIREMENTS	REQUIRED GOVT. ACTION
* Evaluate bids (7-12-2135, MCA)	* Commissioners must open and read bids in a public session * Commissioners may reject bids and readvertise, if in the public interest
* Award contract to lowest Bidder (7-12-2135, MCA)	* Commissioners award contract to lowest responsible bidder * Bid security is retained until contract completed (7-12-2137, MCA)
* If all bids are rejected or no bids are received (7-12-2136, MCA)	* Commissioners may readvertise for bids within six months after the initial bid date
5. RID Implementation	
* Costs are assessed for each lot or parcel based on the relationship between its area and the area of the entire district * If RID is more than five miles from an incorporated city or town, assessment may be based on assessed value of land within district	* County Commission must adopt a method of assessment as prescribed in Montana statutes * County Commissioners must pass a resolution to levy and assess tax on property in the district (7-12-2158 through 7-12-2165, MCA)
* Assessments are collected	* County Treasurer has the responsibility to collect assessments (7-12-2163, MCA) * Revenue collected from assessments shall be placed in RID fund (7-12-2162, MCA)

TABLE 4
(cont.)

REQUIREMENTS	REQUIRED GOVT. ACTION
* Bonds and warrants drawn against fund (construction or maintenance) created for RID (7-12-2171 through 7-12-2182, MCA)	* Board of County Commissioners shall sell bonds or issue warrants to pay for improvements within district in accordance with legal bonding procedures and provisions
	* RID revolving fund shall be established by ordinance to secure prompt payment of RID bonds and warrants
	* Recent legislation allows local governments to issue RID bonds without revolving fund backing. Governing body may be resolution provide that bonds and warrants be payable solely from RID fund and have no claim against revolving fund

requirements of RID formation and identifies the actions required of county government to assure conformance with Montana statutes. Identification of specific provisions relating to RIDs has been included in this table for reference purposes.

iii) Financing Options for RIDs

Methods of financing Rural Improvement Districts are similar to those applicable for Special Improvement Districts. Special assessment bonds are repaid through assessments to individual property owners within the district. Due to the nature of properties generally included in these districts, methods of assessment vary somewhat from those used for SIDs. The assessments for RIDs are generally based on the relationship between the individual property area and the entire area of the district. If the RID is located more than five miles from an incorporated city or town, the assessment may be based upon the assessed value of the property within the district, at the option of the County Commissioners. Additional funding for RID costs may be available from the Community Development Block Grants program, the Coal Board, or the Farmers Home Administration, provided application and eligibility requirements are satisfied.

d. Advantages and Disadvantages of Improvement Districts

i) Advantages

The primary advantage of financing water or sewer system extensions through the creation of an improvement district is that the construction costs of new improvements are borne by those property owners directly benefitted by the improvements. These districts provide an effective method of raising money to finance public improvements without utilizing general fund revenues, since revenue generated through property assessments within the district is used to repay special assessment bonds and meet the costs of providing services. In addition, the long-term repayment of improvement district costs minimizes the financial impacts on property owners within the district. Since SIDs and RIDs are relatively easy to create, improvements may be enacted quickly, provided the district complies with statutory provisions. Formation of these districts is generally acceptable to the public when the proposed facilities or improvements will clearly provide a service desirable to all.

ii) Disadvantages

Costs associated with the administration of RIDs and SIDs by local government may be quite high, and may require expenditures of time and energy even if no local government monies are involved. Improvement districts may also cause assessments to be made against some residents who do not want or cannot afford the project. This situation most often occurs in areas with low- or fixed-income property owners. Since individuals may protest the creation of special districts, significant delays may occur which result in increased project costs. In addition, the manner in which costs for SIDs or RIDs are assessed is likely to create inequities for some property owners within the district.

4. COUNTY WATER AND/OR SEWER DISTRICTS

a. General

Water and sewer districts are generally formed to provide a service that is not being delivered or cannot be delivered by the existing governmental structure. These quasi-municipal units are created by the county at the request of residents within a proposed service district. The district is governed by a board of directors elected by the residents within the service district.

County water and/or sewer districts may be organized, incorporated, and managed for the purpose of providing such services to residents within a designated district. Initially these districts may be created by a petition signed by at least ten percent of the registered voters within the area included in the district. This area may consist of property in more than one county and may include portions of cities or towns.

b. Procedural Requirements

After local residents have presented county government with a petition requesting the creation of a water and/or sewer district, the Board of County Commissions is required to hold a public meeting to hear protests from residents of the proposed district. Based on a review of the petition and the public hearing proceedings, the governing body may modify district boundaries to better serve the public interest. The governing body then calls for a referendum of property owners within the district. If a majority of at least 40 percent of the registered voters within the proposed district approve, the water and/or sewer district may be incorporated. Incorporation allows the district to construct, operate and maintain water and/or sewer systems within the district; to borrow money or issue bonds; and to levy taxes on properties within the district to retire debt incurred by the district. Residents of the district are required to elect a three- to five-member board of directors to oversee the operations of the district. Table 5 summarizes the basic procedural requirements of county water and/or sewer districts and identifies specific statutes that apply to these procedures.

c. Financing Options for Water and/or Sewer Districts

Primary financing of costs incurred for the construction, operation, and maintenance of systems within the district is the responsibility of residents within the district. The board of directors of the district may borrow money or issue bonds to finance initial construction of water or sewer treatment and distribution systems. The major source of

TABLE 5

FORMATION AND OPERATION OF COUNTY WATER AND/OR SEWER DISTRICTS

1. Petition to Create County Water and/or Sewer District (7-13-2204, MCA)

- Must be signed by ten percent of the registered voters of the territory included in the district and presented to the County Commissioners at a regular meeting
- If the district lies in more than one county, the petition must be presented to all boards of county commissioners involved
- The petition shall define the boundaries of the district

2. Public Notification of Petition (7-13-2205, MCA)

- Text of petition must be published once a week for two consecutive weeks in a county newspaper
- Included with the publication of the text must be the time and place of the meeting at which the petition will be presented
- Publication of the petition must be at least two weeks prior to its presentation

3. Hearing on Petition (7-13-2206, MCA)

- Board of County Commissioners shall hear petition and testimony from those presenting the petition
- Board of County Commissioners shall also review written protests filed with the County Clerk & Recorder prior to the hearing
- After review of petition, protests and presentation of all relevant testimony, the Commissioners shall make a decision on the boundaries of the district and give notice of an election to determine if the district should be incorporated (7-13-2211 through 7-13-2215, MCA)

4. Election on Question of Creating a District (7-13-2211 through 7-13-2215, MCA)

- Election shall be held no more than 60 days from the date of the final hearing on the petition to form the water/sewer district
- If at least 40 percent of the registered voters of the proposed district have voted and a majority favor formation of a district, the County Commissioners shall declare the territory duly organized as a county water and/or sewer district
- County Clerk shall file a certificate with the Secretary of State stating that the proposition was adopted. Acknowledgement by the Secretary of State is required for the district to be legally incorporated.
- Incorporation entitles the district to a number of general powers (7-13-2217 through 7-13-2221, MCA)

TABLE 5
(cont.)

5. Organization of the District (7-13-2231 through 7-13-2273, MCA)

- Within 120 days of district formation, voters within the district are required to elect a board of directors
- The board of directors shall consist of:
  - Three to five members if there are no municipalities and ten or less qualified electors in the district; or
  - Three to five members plus one additional director for each municipality in the district (additional directors appointed by mayors of the municipalities)
  - County Commissioners may appoint an additional director if the district contains unincorporated territory
- Term of the office of director varies from two to six years, depending on the make-up of the district
- The election of directors shall occur every four years
- Directors receive monthly compensation

6. Duties of the Board of Directors

- Board holds legislative sessions open to the public, and act only by ordinance and resolution
- Board appoints administrative personnel
- Board establishes charges for services provided by the district to pay operating expenses, interest on any bonded debt, and principal on any outstanding debts
- Board causes taxes to be levied on property for the payment of bonded debt. This procedure is subject to the requirements for public notification and allows residents of the district an opportunity to protest the tax.

7. Procedures to Incur Bonded Indebtedness (7-13-2321 through 7-13-2330, MCA)

- If the Board of Directors deems it necessary for the district to incur bonded indebtedness, it must pass a resolution that declares that fact and indicates the purpose, the land benefitted by the indebtedness, the amount of debt, and the maximum term
- An election on the proposition must be held
- At least sixty percent of the votes cast at the election must approve the bond proposition. The Board of Directors may by resolution provide for the sale and disposition of bonds at times or in a manner deemed to be in the public interest
- Bonds issued by water and/or sewer districts are tax-exempt in Montana

8. Other

- Lands may be added or excluded from the district, subject to the provisions of Montana statutes (7-13-2341 through 7-13-2348, MCA)
- Two or more sewer/water districts may consolidate at any time, subject to provisions outlined in Montana statutes (7-13-2342, MCA))

repayment of this debt is from the establishment of service charges by the district. If this revenue is insufficient, the County Commissioners are empowered to levy taxes on properties within the district. The additional assessment may be based on the relationship that each property's area or taxable valuation bears to the total district's area or taxable valuation.

Federal and state assistance may also be available to county water and/or sewer districts to underwrite portions of costs incurred through construction of facilities. Community Development Block Grants, Farmers Home Administration Water and Waste Disposal Loans and Grants, and Coal Board Grants may be available to communities complying with application and eligibility requirements.

d. Advantages and Disadvantages

i) Advantages

The major advantage of water and sewer districts is that problems regarding political boundaries and jurisdictional responsibilities may be avoided. These districts may consist of several combinations of political subdivisions and are governed by residents within the district. Under proper management, the governing body of the district can function expeditiously in the best interest of the district. The district may be used to fulfill a specific need for residents of a large geographic area and economies of scale may be achieved which may reduce costs somewhat for residents of the district.

ii) Disadvantages

One of the primary disadvantages of water and sewer districts is that they may not be responsive to or consistent with the comprehensive planning efforts of local governments. The provision of one urban service by a district may be counterproductive to community goals and the ultimate plans for numerous community services. Difficulties may be encountered in extending municipal services into areas already served by a similar district. As a result, major adjustments to the system may be necessary, and costs to other city residents may be increased.

5. TAXATION

a. General

Financial support for community water and sewer systems is frequently obtained through taxes based on the assessed value of land and improvements and personal property. Historically, communities have tended to utilize this source of revenue since it has commonly been used to support all local government functions. Revenue to operate water and sewer facilities in the community may be budgeted from the general fund or from a specified levy that is retained in separate accounts and used exclusively for the systems. In recent years, the use of property taxes as the primary source of revenue for the operation of public utilities has declined. Local governments have recognized the need for a broad mix of revenue sources to develop a structure responsive to community growth and local, state and national economic trends.

b. Montana Taxation for Water and Sewer Purposes

i) County Taxation

Montana counties have the power to levy and collect annual taxes on all taxable property within their jurisdiction for the purpose of defraying costs of county services, facilities, or capital projects. Montana statutes limit the size of the annual mill levy to 27 mills for Fourth through Seventh Class Counties and to 25 mills for First through Third Class Counties. If a county government wishes to raise taxes higher than this limitation, it must first pass a resolution indicating its intent to exceed the annual mill levy and then submit the question to qualified electors for approval. For the purposes of financing water and sewer projects, additional county revenues may be obtained from the following levies:

a) Capital Improvement Fund Levy

The fund may be derived from the multiple levies authorized by law; however, no more than ten percent of the money derived from any one levy may be appropriated to this fund. Money in the fund must be expended within ten years for the replacement and acquisition of property, plant or equipment costing more than $5,000 with a life expectancy of more than five years. A capital improvement program must be formally adopted by the county.

b) Rural Improvement District Fund Levy

The Board of County Commissioners may levy taxes on all property within the improvement district to defray the cost of making improvements.

c) Rural Improvement District Revolving Fund Levy

The Board of County Commissioners may levy a tax on all taxable property in the county to secure prompt payment of Rural Improvement District bonds or warrants. The tax may be levied to generate and maintain a fund which equals five percent of the principal amount of outstanding RID bonds or warrants.

d) Water and/or Sewer District Fund Levy

The Board of County Commissioners has the authority to levy and collect taxes on all taxable property within a legally established water and/or sewer district. The levy is intended to provide revenue to repay bond obligations and provide for reserve funds for operation and maintenance of systems within the district.

ii) Municipal Taxation

Municipal governments in Montana have the power to levy and collect taxes for general and special purposes on all taxable property within cities or towns. Cities and towns have the authority to utilize an all-purpose mill levy or a general fund levy to generate revenue to provide community services. Montana statutes limit all-purpose levies to 65 mills and general purpose levies of 24 mills. The total of all taxes for general and municipal purposes may not exceed 15 mills in cities or towns in which statutory limitations regarding bonded indebtedness are either equalled or exceeded.

In addition, local governing bodies may levy taxes for special purposes to supplement either the all-purpose or general fund levies. Maximum levels of assessment for individual special purpose levies are established in State statutes. Prior to the imposition of any special tax, local governments must pass a resolution outlining their intention to exceed the maximum mill levy and submit the question to qualified voters for approval. If a municipal government authorizes an all-purpose mill levy instead of a general fund levy, the governing body must appropriate portions of the levy to its various departments through annual budgeting procedures.

In addition to the all-purpose or general fund mill levies used by municipal governments, revenues for water and sewer projects may be obtained from the following levies.

a) Capital Improvement Fund

A municipality utilizing an all-purpose levy may place up to five percent of the levy in a separate fund earmarked for the replacement and acquisition of property, plant or equipment costing in excess of $5,000 with a life expectancy of more than five years. This option is available to municipalities that have formally adopted a capital improvements program.

b) Special Improvement District Fund Levy

The governing body of any municipality may levy taxes on all property within the district to defray the cost of all improvements.

c) Special Improvement District Revolving Fund Levy

The governing body may levy a tax on all taxable property in the municipality to secure the prompt payment of Special Improvement District bonds or warrants. The tax may be levied to generate and maintain a fund which equals five percent of the principal amount of outstanding SID bonds or warrants.

c. Advantages and Disadvantages

i) Advantages

Financial support of community water and sewer services through property taxation allows the entire community to pay for the overall benefits afforded by the system, such as the avoidance of health and pollution hazards. This form of taxation also provides a means of obtaining financial contributions from the owners of undeveloped property for the benefit of having community water and/or sewer service available to the property. At the time the undeveloped property is improved, the increase in property tax will offset the increased usage of the services.

Administration of a system utilizing property taxes as the primary source of operating revenue for community services is simple, requiring no measurement of water or wastewater quantities to assess user charges. The additional accounting and billing procedures required by such a system are minimal. In addition, the tax system offers some benefits to individual property owners in that charges in the form of property taxes are tax-deductible, whereas service charges are not.

ii) Disadvantages

One of the primary disadvantages associated with the use of property taxes as a means of financing community services is the generally unfavorable response by citizens to a tax increase. Since voter approval of tax measures is required, additional revenue to offset operation and maintenance costs of community water and sewer systems may be difficult to obtain. This system may also place a disproportionately large burden for community services on agricultural operations, commercial or industrial concerns that own large parcels of property but do not extensively use community water and sewer services. Problems may also be encountered in developing areas adjacent to the community, since a few landowners may be required to pay for large portions of the improvement costs. (However, this should be largely offset by future profits for these landowners when the areas are fully developed.) In addition, property taxes do not respond to inflation unless reassessment of taxable property occurs regularly to keep pace with increases in property values.

REFERENCES FOR PART IV

1. Briscoe, Maphis, Murray, Lamont, Inc., Action Handbook: Managing Growth in the Small Community - Part III: Community Action and Growth Management, prepared for the Environmental Protection Agency, Report No. EPA-908/4-78-005c, July, 1978.

2. ________, Capital Improvements Programming Handbook - A Guide for Local Governments in North Dakota, 1981.

3. Burrus, William, Clarke, David and Gottsfield, Robert, "What Clients Want Lawyers to Know About Municipal Bonds", Corporate, Fall, 1979.

4. "Draft Working Paper on Financing Infrastructure for Economic Development", Government Finance Research Center, Washington, DC, February, 1983.

5. Ecker-Racz, L. Laszlo, It's Your Business: Local and State Finance, National Municipal League, New York, NY 1976.

6. Faas, Ronald, Young, Douglas, and Wandschneider, Philip, How Municipal Capital Projects are Financed, Western Rural Development Center, WREP 61, Corvallis, Oregon, June, 1982.

7. Financing and Charges for Wastewater Systems, prepared by the American Public Works Association, American Society of Civil Engineers, Water Pollution Control Federation, Chicago, Illinois, 1973.

8. Fundamentals of Municipal Bonds, Public Securities Association, New York, New York, 1981.

9. Issuing Municipal Bonds: A Primer for Local Officials, U.S. Department of Agriculture, Economics, Statistics & Cooperative Service, Agricultural Information Bulletin #429, Washington, DC, July, 1979.

10. Mizner and Williams in cooperation with the Montana League of Cities and Towns, Handbook for Municipal Officials, 1982.

REFERENCES
(cont.)

11. Ragowski, Robert and Tangedahl, Lee, "Borrowing Costs for New Montana Municipal Bond Issues", Montana Business Quarterly, Winter, 1978.

12. Richard, James, Capital Facilities Programming: An Introduction (Draft), prepared for the Montana Department of Commerce, May, 1983.

13. Sewage Treatment and Solid Waste Disposal Facility Financing Study, prepared by Pacific Economics, Inc. for the Oregon Department of Environmental Quality, Salem, Oregon, May, 1981.

14. "User Charges - An Overlooked Revenue Source", Illinois Department of Commerce & Community Affairs, Cost Cutters Project Publication 6, Springfield, Illinois, October, 1981.

15. Walzer, Norman and Chicoine, David, Financing State and Local Governments in the 1980's, Oelgeschlager, Gunn & Hain, Publishers, Inc., Cambridge, Massachusetts, 1981.

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Appendix A: Glossary of Basic Financing Terms

Ad Valorem Tax: A tax based on value, such as the assessed value of real (land and improvements) and personal property.

Advance Refunding Bonds: Bonds issued to refund an outstanding bond issue prior to the date on which the outstanding bonds become due or callable. Proceeds of the advance refunding bonds are deposited in escrow with a fiduciary, invested in U.S. Treasury Bonds or other authorized securities, and used to redeem the underlying bonds at maturity or call date and to pay interest on the bonds being refunded or the advance refunding bonds.

Since the investments in which the proceeds of the advance refunding issue are invested will frequently earn a higher rate of interest than that paid on the outstanding bond issue and the advance refunding issue, the issuing agency may realize a net interest gain from the refunding operation.

Amortization: A straight-line reduction of debt by means of periodic payments sufficient to meet current interest and liquidate the debt at maturity.

Arbitrage: The practice of investing bond proceeds at a yield greater than the coupon rate being paid on the bonds. This "profit" is strictly limited by the Internal Revenue Service.

Authorization: Permission to issue the bonds. In addition to the Constitution, Statute or Charter enabling language, an election is often also required.

Bid: A statement of what a bank or syndicate of banks will pay for an entire bond issue, implying an offer to purchase the bonds. The lowest bid, i.e., the bid with lowest net or true interest cost, is the winning bid.

Bond: A certificate representing a promise to pay a specified sum of money, called the face value or principal amount, at a specified date or dates in the future, called the maturity date(s), together with periodic interest at a specified rate. The difference between a note and a bond is that the latter runs for a longer period of time and is usually a permanent financing tool while a note is typically an interim device.

Bond Anticipation Note (BAN): Short-term interest bearing notes issued by a government unit in anticipation of bonds to be issued at a later date. The notes are retired from proceeds of the bond issue to which they are related.

Bond Buyer: A daily trade paper of the municipal bond market. It also publishes "The Weekly Bond Buyer", which is devoted to capital market news and provides a summary of the week's municipal news.

Bond Counsel: Legal firm hired to advise the Issuer regarding the legal and tax aspects of the sale.

Bond Ordinance or Resolution: A legal order approved by the appropriate body of a government unit authorizing a bond issue. The rights of the bondholders and the obligations of the issuer are carefully detailed in this formal document. State laws and municipal charters prescribe whether a bond issue may be authorized by resolution, or must be made by ordinance. The latter is a more formal act of the governing body.

Bond Issue: Bonds sold.

Bond Payable: The face value of bonds issued and unpaid.

Budget (Operation): A plan of financial operation embodying an estimate of proposed expenditures for a given period and the proposed means of financing them. Used without any modifier, the term usually indicates a financial plan for a single fiscal year. The term "budget" is used in two senses in practice. Sometimes it designates the financial plan presented to the appropriate body for adoption and sometimes the plan finally approved by that body. It is usually necessary to specify whether the budget under consideration is preliminary and tentative or whether it has been approved by the appropriating body.

Call Date: The date on which a bond may be redeemed before maturity at the option of the Issuer.

Call Feature (Redemption Feature): Enables the Issuer to pay off ("redeem") a bond prior to its maturity date. The "call date" is the earliest date the bond may be redeemed ("called"). Usually a premium is paid for the earliest call dates.

Callable Bond: A type of bond which permits the Issuer to pay the obligation before the stated maturity date by giving notice of redemption in a manner specified in the bond contract. (Synonym: Optional Bond)

Call Price: The price at which callable bonds will be redeemed if called.

Capital Budget: A plan of proposed capital expenditures and the means of financing them. The capital budget is usually adopted as part of the complete annual budget which includes both operations and capital outlays. The capital budgets should be based on a capital improvement program (CIP).

Capital Improvement Program: A plan for capital expenditures to be incurred each year over a fixed period, setting forth each capital project, identifying the expected beginning and ending date for each project, the amount to be expended in each year, and the method of financing those expenditures.

Capital Outlays: Expenditures for the acquisition of capital assets.

Capital Projects: Projects which purchase or construct capital assets. Typically a capital project encompasses a purchase of land and/or the construction of a building or facility.

Capital Projects Fund: A fund created to account for all resources used for the acquisition of designated fixed assets by a governmental unit except those financed by special assessment and enterprise funds.

Competitive Bidding (also called Public Bidding): Sale of a bond issue by public advertisement in which any bidder may submit an offer to purchase the bonds and the bonds are sold to the bid with lowest interest cost.

Covenant: A binding agreement in the bond contract. Most are found in revenue bonds. For example, they can stipulate that the rates charged for use of the facilities are sufficient to maintain coverage of maximum annual debt service at a given level.

Coverage: This term is usually connected with revenue and corporate bonds. It is usually the ratio of net revenue available for debt service to the average annual debt service requirements for an issue of revenue bonds. This ratio indicates the margin of safety for payment of debt service, reflecting the number of times by which earnings for a period of time exceed debt service payable in such periods; e.g., 1.20, referred to as "one-twenty".

Current Yield: A relation stated as a percentage of the annual interest to the actual market price of the bond; the same procedure is used as in computing a stock yield.

Debt: An obligation resulting from the borrowing of money or from the purchase of goods and services. Debts of governmental units include bonds, time warrants, notes, and floating debt.

Bonds: An interest-bearing promise to pay with a specific maturity.

Notes: In general, an unconditional written promise signed by the maker to pay a certain sum of money on demand or at a fixed or determinable time either to the bearer or to the order of a person therein.

Time Warrant: A negotiable obligation of a governmental unit having a term shorter than bonds and frequently tendered to individuals and firms in exchange for contractual services, capital acquisitions, or equipment purchases.

Floating Debt: Liabilities other than bonded debt and time warrants which are payable on demand or at an early date. Examples are accounts payable, notes and bank loans.

Debt Limit: The maximum amount of debt which a governmental unit may incur under constitutional, statutory, or charter authorizations. The limitation is usually a percentage of assessed valuation and may be fixed upon either gross or net debt. If the latter is the case, the legal provision will usually specify what deductions from gross debt are allowed in order to determine net debt.

Default: Failure to pay principal or interest promptly when due. If caused by a minor omission which is remedied promptly, it is known as a "Technical Default".

Depreciation: 1) Expiration of the service life of capital assets attributable to wear and tear, deterioration, action of the physical elements, inadequacy or obsolescence; 2) That portion of the cost of a capital asset which is charged as an expense during a particular period.

Discount: The difference between the cost price of a security and its value at maturity when quoted at lower than face value. A security selling below original offering price shortly after sale also is considered to be at a discount. Note that the price does not include accrued interest at the date of acquisition or sale.

Encumbrances: Obligations in the form of purchase orders, contracts or salary commitments which are chargeable to an appropriation and for which a part of the appropriation is reserved. They cease to be encumbrances when paid or when an actual liability is established.

Face Value: The par value of a bond that appears on the face. This is the amount that the Issuer promises to pay at maturity, and also the amount on which interest is computed.

Financial Consultant or Advisor: Consulting firm or individual hired to advise the Issuer regarding the financial and market aspects of the sale.

Fiscal Agent: An agent (usually an incorporated bank or trust company) designated by a government to act for it in any of several capacities in the sale, administration and payment of bonds and coupons.

Fiscal Year: A twelve-month period of time to which the annual budget applies and at the end of which a governmental unit determines its financial position and the results of its operations. For example, the State of Oregon's fiscal year starts July 1.

Full Faith and Credit: A pledge of the general taxing power for the payment of debt obligation. Bonds carrying such pledges are usually referred to as general obligation bonds or full faith and credit bonds.

General Obligation Bond: A bond for whose payment the full faith and credit of the issuer is usually pledged. Most commonly, general obligation bonds are payable from ad valorem property taxes.

Grant: A contribution of assets (usually cash) by one governmental unit or other organization to another. Typically, these contributions are made to local governments from the state and federal governments. Grants are usually made for specified purposes.

Industrial Development Revenue Bonds (IDBs, IDRBs, IRBs): Bonds issued by governmental units, the proceeds of which are used to construct plant facilities for private industrial concerns. Lease payments made by the industrial concern to the governmental unit are used to service the bonds. Such bonds may be in the form of general obligation bonds, revenue bonds, or a combination thereof.

Interest: Compensation paid or to be paid for the use of money, including amounts payable at periodic intervals or as discount at the time a loan is made.

Interest Rate: The interest payable, expressed as a percentage of the principal available for use during a specified period of time.

Interim Borrowing: 1) Short-term loans to be repaid from general revenues during the course of a fiscal year; 2) Short-term loans in anticipation of tax collections or bond issuances. (See Bond Anticipation Notes)

Investor (Bondholder): Ultimate buyer of any number of bonds from an issue who intends to hold the bonds for investment purposes.

Issuer: A municipal unit which borrows money through the sale of bonds, notes, or other evidence of indebtedness.

Lease or Lease - Purchase Revenue Bonds: Revenue bonds paid from lease payments made on projects financed by bonds.

Legal Opinion: The opinion of a specialized bond attorney as to the legality of a municipal bond issue. A preliminary legal opinion is made in advance of the original sale of the bonds; the final opinion, after the bonds have been sold and issued.

Levy: 1) To impose taxes, special assessments, or service charges for the support of governmental activities; 2) The total amount of taxes, special assessments, or services charges imposed by a governmental unit.

Long-Term Debt: Debt with a maturity of more than one year after date of issuance.

Market Price: The price of an issued bond varies continuously as new bond issues come to market and previously issued bonds are retraded. Thus, the market price that an Investor will pay for a ten-percent, ten-year bond today may be different tomorrow. Therefore, the total market value of a portfolio changes daily.

Marketability: A measure of the ease with which a security can be sold in the secondary market.

Maturity: The date upon which the principal or stated value of a bond becomes due and payable.

Maturity Schedule: A listing of the total principal amount of bonds maturing in each year.

Municipal: In its broadest sense, an adjective which denotes the state and all subordinate units of government. In a more restricted sense, an adjective which denotes a city or town as opposed to other units of local government.

Negotiated Sale: The private arrangement between two or more parties to purchase the securities of an issuer without competitive public bidding.

Notice of Sale: Legal notice announcing the terms and conditions of the bond sale. Its contents and timing for publication are prescribed by Statute. Official Statements must be available for distribution on the first day ("first publication date") the notice of sale is published.

Official Statement (OS, also called Prospectus): The legal disclosure document prepared by a municipal bond issuer or its chosen representative, which sets forth all material facts necessary to fully describe the financial condition of the issuer and clarify the offering, as prescribed by law.

Par Value: The value of a security as expressed on its face without consideration to any premium or discount; it is the amount that must be paid at maturity. It also signifies the dollar value on which bond interest is figured. Although bonds are usually issued in denominations of $5,000, a quotation of 100 means "at par". Bonds quoted at 98 are selling at a discount; that is, they cost $980 for a $1,000 bond. Bonds quoted at 102 are selling at a premium; that is, $1,020 for a $1,000 bond.

Pay-As-You-Go Basis: A term used to describe the financial policy of a governmental unit which finances all of its capital outlays from current revenues rather than by borrowing. A governmental unit which pays for some improvements from current revenues and others by borrowing is said to be on a partial or modified pay-as-you-go basis.

Paying Agent: The agency, practically always a commercial bank, where the maturing interest coupons and principal of an issue will be paid. Municipal bonds usually are payable also at the office of a public treasurer.

Premium: The excess of the price at which a bond is acquired or sold over its face value or maturity value. Note that the price does not include accrued interest at the date of acquisition or sale. Also, the premium is the amount payable to the holder of a callable bond by the issuer, if and when the bond is called and assuming there is provision for a call premium.

Principal: The face or par value of a bond, exclusive of accrued interest.

Prospectus: A detailed statement issued by a company or municipality prior to the sale of new or additional securities, giving a full description of facts and information as required by the Securities and Exchange Commission or other authority.

Public Bidding: A method of issuing debt in which the issue is advertised in a financial journal and any investor is welcome to submit an offer to purchase.

Qualified Legal Opinion: Conditional affirmation of the legality of bonds, before or after they are sold. An Unqualified Legal Opinion, on the other hand, is an unconditional affirmation of the legality of the bonds.

Rating: The designation used by investors' services to give relative indications of quality. Moody's ratings range from the highest, Aaa, down to C, while Standard and Poor's ratings range from the highest, AAA, down D.

Refinancing: Retiring existing securities by the sale of new issues. The objective may be to save interest costs or to extend the maturity of the loan.

Refunding Bond: A bond issued to retire a bond already outstanding. Refunding bonds may be sold for cash and outstanding bonds redeemed in cash, or the refunding bonds may be exchanged with holders of outstanding bonds.

Registered Bond: A bond whose owner is registered with the issuing governmental unit and which cannot be sold or exchanged without a change of registration. When fully registered, there are no coupons attached and the interest is paid to the owner by check by the paying agent. Registered bonds may be registered as to principal and interest or as to principal only.

Reserve: An account used to indicate that a portion of fund equity is legally restricted for a specific purpose or not available for appropriation and subsequent spending.

Revenue Bonds: Bonds whose principal and interest are payable exclusively from earnings of a public enterprise, such as bridges, toll roads, or utility systems. Such bonds have no claim on the borrower's taxable resources unless otherwise specified in the bond indenture. In addition to a pledge of revenues, such bonds sometimes contain a mortgage on the enterprise's property, and are then known as Mortgage Revenue Bonds.

Serial Bonds: Bonds the principal of which is repaid in periodic installments over the life of the issue.

Serial Annuity Bonds: Serial bonds in which the annual installments of bond principal are so arranged that the combined payments for principal and interest are approximately the same each year.

Deferred Serial Bonds: Serial bonds in which the first principal installment does not fall due for two or more years for the date of issue.

Short-Term Debt: Debt with a maturity of one year or less after the date of issuance. Short-term debt usually includes floating debt, bond anticipation notes, tax anticipation notes, and interim warrants.

Sinking Fund: A fund of earning assets and cash to which additions are made periodically so that future contributions plus interest earned will accumulate to the par value of the bonds at maturity and can thus be used to redeem them. Difficulties of administration have made this practice rare today, but the term is sometimes used to cover any retirement of principal other than by serial maturities. Thus, a call of a part of a bond issue in order to retire debt may be called "for sinking-fund purposes".

Special Assessment: A compulsory levy made by a local government against certain properties to defray part or all of the cost of a specific improvement or service which is presumed to be of general benefit to the public and of special benefit to such properties. The term should not be used without a modifier (e.g., "special assessments for street pavings" or "special assessments for street sprinkling") unless the intention is to have it cover both improvements and services or unless the particular use is apparent from the context.

Tax-Exempt Bond: Bonds exempt from federal income, state income, or state or local personal property taxes. "Municipals" are exempt from federal income taxation at present and may or may not be exempt from state income or personal property taxation in the state where originally issued or held. Most states do not tax "municipals" issued by their own state or local jurisdictions.

Tax-Increment Revenue Bond: Also called Tax Allocation Bond or Urban Renewal Bond, it is a form of revenue bond paid from monies derived from "tax increment financing", a special application of taxes levied in urban renewal districts on the growth in taxable value.

Taxes: Compulsory charges levied by a governmental unit for the purpose of financing services performed for the common benefit. The term does not include specific charges made against particular persons or property for current or permanent benefits such as special assessments. Neither does the term include charges for services rendered only to those paying such charges as, for example, sewer service charges.

Term Bonds: Bonds the entire principal of which matures on one date. Also called Sinking Fund Bonds.

Underwriter: The investment house or houses that purchase a bond offering from the issuing government. A joint venture account of a number of underwriters is called the Underwriting Syndicate or Syndicate.

Warrant: An order drawn by the legislative body or an officer of a governmental unit upon its treasurer directing the latter to pay a specified amount to the person named or to the bearer.

Yield: The rate earned on an investment based on the price paid for the investment, the interest earned during the period held and the selling price or redemption value of the investment.

SOURCE: Excerpted from Capital Planning and Debt Issuance: An Informational Manual for Oregon Municipalities, Municipal Bond Division, Oregon State Treasury, Salem, Oregon, 1982.

Appendix B: Case Study of Financing Municipal Improvements — Chinook, Montana

A. General

Over the past ten years the City of Chinook has made numerous improvements to their public facilities including water and sewer replacement and extension projects, water and sewer treatment projects, and storm drainage, curb and gutter, and street improvements. For most of these improvement projects, the City secured loans and/or grants from various federal agencies to assist in financing the projects. Without this federal assistance, the community's tax assessments and user charges would have been substantially higher than they are today, and in many cases the excessive project costs would have prohibited the implementation of the improvements.

B. Summary of Projects

Included in Table B-1 is a brief summarization of the project costs and funding breakdown for the major improvement projects completed by the City of Chinook over the past ten-year period. As can be noted, the City utilized various combinations of financing options to obtain the funds required for the projects. These options included: 1) utilizing federal grants and loans; 2) forming special improvement districts and correspondingly selling special assessment bonds; 3) selling revenue bonds and correspondingly raising user fees to pay back the bonds; and 4) utilizing available revenue sharing and gas tax monies allocated to the City.

TABLE B-1

SUMMARY OF IMPROVEMENTS PROJECTS - CHINOOK, MONTANA

	FUNDING SOURCE				
Project	Grant	FmHA Loan	Sale of Bonds	Other Local Funds	Total Cost
New Water Treatment Plant	$ 600,000 (EDA)	-	$ 400,000 (Rev. Bnd.)	-	$1,000,000
Extension of Water System to Northside of Community	200,000 (HUD)	-	-	-	200,000
New Storm Drainage System	300,000 (EDA)	-	-	$ 150,000 (Rev. Shr.)	450,000
Extension of Sewer System to Northside of Community	150,000 (EPA)	$ 50,000 (SID)	-	-	200,000
Replacement of Water System (valves, services, fire hydrants, mains, etc.)	-	200,000 (Rev. Bnd.)	-	-	200,000
Storm Drainage Extension	-	-	-	150,000 (Gas Tax)	150,000
New Citywide Curb, Gutter, & Street Paving Project	-	-	2,400,000 (SID)	-	2,400,000
New Wastewater Treatment Plant	1,800,000 (EPA)	-	600,000 (Rev. Bnd.)	-	2,400,000
TOTAL:	$3,050,000	$250,000	$3,400,000	$300,000	$7,000,000

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